OPERATING AND SERVICE MANUAL

MODEL 302

FREQUENCY COUNTERS

WESTON®

prime source
for precision...
since 1888

WESTON INSTRUMENTS, INC.
a Schlumberger company

TO OPEN
PUSH CENTER RING
UP ½"
& SWING TO LEFT.

Serial Number_____

OPERATING AND SERVICE MANUAL

MODEL 302

FREQUENCY COUNTERS

WESTON-LEXINGTON
Weston Instruments Division
17 Hartwell Avenue
Lexington, Massachusetts 02173

This manual describes units with serial numbers 26 and higher

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W A R R A N T Y

Weston-Lexington warrants each instrument manufactured by them to be free from defects in material and workmanship. Their obligation under this Warranty is limited to servicing or adjusting any instrument returned to the factory for that purpose, and to replace any defective parts thereof. This Warranty is effective for one year after delivery to the original purchaser when the instrument is returned transportation charges prepaid by the original purchaser, and when upon examination it is disclosed to be defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed to the customer. In this case, an estimate will be submitted before work is started.

IF ANY FAULT DEVELOPS, THE FOLLOWING STEPS SHOULD BE TAKEN:

1. Notify Weston-Lexington giving full details of the difficulty; include the Model number and serial number. On receipt of this information, service data or shipping instructions will be given.
2. On receipt of shipping instructions, forward the instrument prepaid to the factory or to the authorized repair station indicated. If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the Warranty.

SECTION 1

GENERAL DESCRIPTION

The Weston Model DRO 300 Series Frequency Counters are extremely suitable for the measurement of frequencies in the region 1 Hz to 200 kHz. The feature of the DRO 300 Series which distinguishes them from other counters is that frequency may be measured as the reciprocal of the period. Thus accurate measurements of frequency are made in a short time; typically the frequency of a 10 Hz signal is measured with 0.01% accuracy in 0.12 seconds, or 100 Hz frequency can be measured within 0.21 seconds with the same accuracy. One of the series, the Model DRO 302 Counter, in addition to measuring frequency as the reciprocal of period, measures frequency in the conventional manner with a maximum counting rate of 1 MHz, and period with a resolution of 1 μsecond.

Features

Five in-line decade indicators and one over-range indicator.

Read-out storage between computations.

Variable storage time.

Crystal controlled time base.

Units display indicator.

Automatic positioning of decimal points.

Off scale indication.

Update indication.

Push button reset (Model DRO 302 only).

0.5 Hz measurement (Models DRO 301 and 302 only).

3-1/2" height.

Features (Cont'd)

Remote range control in Computed Frequency Mode.

Operation Check mode.

Options

Remote control of the start of measurement and read-out available. (Read-out in 1-2-4-8 code).

SECTION 2

SPECIFICATIONS

2.1. FREQUENCY COUNTER, MODEL 300

The Model 300 is a Frequency Counter, which determines the frequency of a periodic voltage by computing the number 1/T. The basic Model 300 has rear-panel, remote scale-control for direct input from Weston Model 100 series oscillators or remote scale-control through external contact closures from other sources.

Display:

(1) 5 "Nine's" with "1" digit over-range (gaseous discharge indicators).

(2) Display varies from 5000 to 199,999.

(3) "Off Scale" indication below 5000 and above 199,999.

(4) Automatic positioning of decimal-point indicators.

Frequency Range:

(1) 5.000Hz to 200,000Hz

(2) 4 Nominal Decade Ranges (Hz)

(a) 10 - 100Hz (X1)
(b) 100 - 1000Hz (X10)
(c) 1000 - 10000Hz (X100)
(d) 10000 - 100,000Hz (X1000)

each range can display 1/2 the lowest nominal reading and 2X the highest nominal reading.

Display Accuracy:

(1) 0.01% Reading ± 1 count over Nominal Decade Range (including crystal stability) ± noise.

(2) Internal noise: 400μV rms typical, 600μV rms maximum. See note*

(3) 1MHz clock available as external calibration signal.

Display Time:

Continuously variable from a minimum approaching "Frequency Computing Time" **(See below) to "Infinite".

Controls, Front Panel:

Function
(a) Computed Frequency
(b) Self Check

Display Time

Power on-off

Inputs: (All inputs on rear panel via barrier strip)

(1) Signal Input:

(a) 1V rms minimum amplitude periodic signal; 125V rms maximum.
(b) Input Impedance 39K ohms (nominal).

(2) Control Inputs:

Four contact closures to one common return (to select Frequency Range).

*Noise:

The frequency measurement error due to noise may be calculated by the formula $\Delta = \frac{100\ N}{\pi\ n\ S}$

where Δ is the error in percent
N is the noise level in volts
S is the input signal level in volts
n is the numbers of periods averaged.

**Frequency Computing Time = $\frac{1}{f} + \frac{0.002f}{M}$

where f is the frequency being measured
m is the Range Multiplier as marked on the front panel

approximately 0.12 seconds for the lowest frequency (10Hz)
approximately 0.21 seconds for the highest frequency (100Hz)
for the 10-100Hz range.

Physical:

3-1/2" High x 17" Wide x 16" Deep

Relay Rack Mountable (with rack mounting ears Part # 03-117-280-2)

Weight: 23 pounds

Power: 115-230 volts 47-66Hz

Power Consumption: 35 watts at 115 volts, 60Hz AC

Operating Temperature Range: 10-40°C ambient

2.2. FREQUENCY COUNTER, MODEL 301

The Model 301 is identical to the Model 300, with additional features of:

(1) 100mV rms minimum input periodic signal.

(2) Internal noise 50μV typical, 100μV maximum. (<1 pt in 10^5 for 12V input) See note* Model 300.

(3) Front panel input connectors (AC and DC coupled).
100,000 ohms nominal input impedance.
150V rms maximum input voltage.

(4) Front panel input Sensitivity control.

(5) Front panel Frequency Range selector.

(X1, X10, X100, X1000 and Remote)

(6) Additional Computed Frequency function, ranges divided by 10:

covering 0.5 to 20,000Hz

4 nominal decade ranges.

1.0 - 10Hz
10 - 100Hz
100 - 1000Hz
1000 - 10,000Hz

each range can display 1/2 the lowest and 2X the highest nominal reading.

2.3. FREQUENCY COUNTER, MODEL 301C (Automatic Ranging)

Display:

(1) 5 "Nine's" with "1" digit over-range (gaseous discharge indicators).

(2) Display varies from 5000 to 199999.

(3) "Off Scale" indication below 5000 and above 199,999.

(4) Automatic positioning of decimal-point indicators.

Frequency Range:

(1) 0.5Hz to 200,000Hz

(2) 5 Nominal Decade Ranges (Hz)

(a) 1-10Hz
(b) 10-100Hz
(c) 100-1000Hz
(d) 1000-10000Hz
(e) 10000-100000Hz

each range can display 1/2 the lowest nominal reading and 2X the highest nominal reading.

Display Accuracy: (10-40°C)

(1) 0.01% Reading ±1 count over nominal Decade Range ± noise (including crystal stability)

(2) Internal noise: 50μV rms typical, 100μV rms maximum See note*

(3) 1MHz clock available as external calibration signal.

Display Time:

Continuously variable from a minimum approaching "Frequency Computing Time" **(See below) to "Infinite".

Units indicator lights during up-dating of information.

Controls, Front Panel

Function
(a) Computed Frequency - Automatic ranging
(b) Computed Frequency - Manual
(c) Self Check

Decade Range (for Computed Frequency-Manual)

Input Sensitivity

Display Time

Power on-off

Input Connectors

Front panel input connectors (AC and DC coupled)

Inputs:

Signal Input:

(a) 100 mV rms minimum amplitude periodic signal. Threshold detector prevents retriggering on noise.
(b) Input impedance 100K ohms (nominal)

*Noise:

The frequency measurement error due to noise may be calculated by the formula: $\Delta = \frac{100\ N}{\pi\ n\ S}$

where Δ is the error in percent
N is the noise level in volts
S is the input signal level in volts
n is the numbers of periods averaged

**Frequency Computing Time = $\frac{1}{f} + \frac{0.002f}{M}$

where f is the frequency being measured
M is the Range Multiplier as marked on the front panel.

approximately 0.12 seconds for the lowest frequency (10Hz)
approximately 0.21 seconds for the highest frequency (100Hz)
for the 10-100Hz range.

Physical:

3-1/2" High x 17" Wide x 16" Deep

Relay Rack Mountable (with rack mounting ears, Part # 03-117-280-2)

Weight: 23 pounds

Power: 115 or 230 volts, 47-66Hz.

Power Consumption: 35 watts at 115 volts, 60Hz AC

Operating Temperature Range: 10-40°C ambient

2.4. FREQUENCY COUNTER, MODEL 302

The Model 302 Frequency Counter is identical to the Model 301, with the additional features of:

(1) Axis Crossing Frequency Measurement up to 1MHz.

(2) Period Measurement:

(a) 1μ sec. resolution.
(b) number of cycles over which period is averaged 1, 10, 10^2, 10^3.
(c) Display directly in microseconds.

(3) Reset button to set counter to all zeros.

2.5. OPTIONS

2.5.1. Option C: 6 "nines" Display for Period and Axis-Crossing Frequency only. (Model 302 only)

2.5.2. Option B:

Remote Programming of Counting Cycle with BCD Print Out.

Specifications for option D (see 2.5.3 below) apply in addition to the following:

(a) Computing cycle starts for negative-going transition, from +2 (or greater) volts to 0 (1000Ω input impedance), and lasting at least 10 microseconds.

(b) Print command is available to indicate updated data as in Option D.

(c) Local-Remote front panel switch selects remote or internal cycling.

(d) Function and Range selection in accordance with basic unit specifications.

(e) Display Count Feature is disabled in this option.

2.5.3. Option D: BCD Printer Drive

Outputs:

(a) 5 BCD digits

(b) 1 over-range digit (optional 6th digit available with Option C)

(c) 1 BCD representing $x10^{-n}$, n = 0, 1, 2, 3, 4, (decimal point information); 3 binary digits

(d) Units Indication:
- Hz
- kHz
- μsec
- Self-Check
- OFF Scale High
- OFF Scale Low

(e) Print Command

All output signals available in positive (+12V) or negative (-12V) logic. Logic 1 is the high value in positive (12V) or negative (-12V) logic. Source resistance is 4700Ω. (Complimentary logic on special order also available).

"Print Command" duration is controlled by Display Time Control (variable from approximately 0.05 to 1 second).

SECTION 3

OPERATING INSTRUCTIONS

Precaution

The application of voltages in excess of 200 volts AC or DC to any input connection may damage the Counter.

3.1. MODEL 300 (See Figure 3-1)

The Model 300 is specifically intended for remote operation with the Weston Precision Oscillators or any other oscillator having controls suitable to activate the Model 300 remotely. All external connections are made on the rear panel of the Model 300; a minimum number of controls has been placed on the front panel.

3.1.1. LINE POWER

The Model 300 Frequency Counter may be placed in operation by connecting a source of power from the power lines through receptacle J1 on the rear panel by means of the power line cord. Units are wired in accordance with customer's order for 115 volts or 230 volts AC line power. A unit wired at the factory for 115 volts AC line power has wires on transformer T1 between terminals 1 and 3 and between terminals 2 and 4. To convert the unit to 230 volts AC line power, the latter two wires should be removed and replaced by a single wire between terminals 2 and 3. Power is turned on and off on the front panel, and Power On is indicated by a lighted lamp on the power switch.

3.1.2. SIGNAL CONNECTIONS AND FREQUENCY SCALE SELECTION

The high and low lines of the input signal are connected respectively to TB1 positions 1 and 2 on the rear panel of the Model 300 (see Figure 3-1). A frequency scale suitable for the

measurement may be selected by connections between TB1 position 7 and any one of positions 3, 4, 5 and 6. When used with any of the Weston Precision Oscillators, an optional accessory cable provides the interconnections.

3.1.3. SELF CHECK

The Counter may be checked for operation by placing the Function Selector switch in the Self Check position. A reading of 100000 or 99996 is observed for correct operation. (6 "nines" option a reading of 100002 also indicates correct operation).

3.1.4. NORMAL USE

Thereafter, the Function Selector switch may be placed in the Computed Frequency position for normal use, reading frequency on the visual display devices.

3.1.5. DISPLAY TIME AND UPDATING INDICATION

The Display Time control determines the duration of the display; full clockwise rotation causes the display to be held indefinitely; full counter-clockwise rotation of the control provides minimum display time (approximately 50 milliseconds). The unit's indicator will display the letters HZ for hertz. The unit's indicator blinks every time an updated reading is to be presented. If the indicator is off permanently, either the Display Time control has been set to its maximum clockwise position or the input signal has been disconnected.

3.2. MODEL 301 (See Figure 3-2)

The Model 301 Frequency Counter is intended for general purpose use in the measurement of frequency in the range 1 cycle to 200,000 cycles. The Model 301 operates in the Computed Frequency mode, as does the Model 300. It has the same features as the Model 300 with the additions of front panel AC and DC Input Connectors, input signal Sensitivity Control, input signal Slope Selector, front panel control of the frequency range, rear input External Clock and a Function switch position which establishes a frequency scale divided by ten, thereby extending the range of the Counter to 1 Hz.

3.2.1. REMOTE OPERATION

The Counter may be placed in operation and operated as described above under the Model 300 when the Range switch is placed in the Remote position. In that event, all connections

are made via TB-1 and the Function switch is placed in Computed Frequency 10 Hz to 100 kHz.

3.2.2. INPUT CONNECTIONS AND CONTROLS

If it is desired to apply signals to be measured at the front panel, the signal may be connected through input BNC connectors labeled AC or DC. If the input signal has appreciable DC component (if the DC component of the signal is greater than 1/10th the peak amplitude of the signal), it should be applied through the AC input. The Sensitivity Control should be adjusted to that maximum counter-clockwise position which still allows reliable counting. If the positive slope of the waveform is steeper than the negative slope, the Slope Selector switch should be placed in the Positive position, and vice versa.

3.2.3. SELECTION OF RANGES

The Range Selector switch should be set in that position which causes "on scale" readings; the number of periods required is indicated on the panel, i.e., if the frequency is 50 Hz, it should be measured on that scale reading 10 to 100 Hz, the X1 position, although on-scale readings will occur for any value from 5 Hz to 200 Hz on that scale. 5 Hz may be read with greater resolution by placing the Function switch in the 1 Hz-10 kHz position. 200 Hz may be measured with greater speed with the Function Selector switch in the position 10 Hz to 100 kHz, and the Range Selector set on the position "10", 100 Hz to 1000 Hz.

3.3. MODEL 301C (See Figures 3-3A and 3-2B)

The Model 301C Frequency Counter is intended for general purpose use in the measurement of frequencies in range 0.5 to 200,000 Hz. The Model 301C operates in the computed (reciprocal) frequency mode, and has the feature of automatically selecting the proper range to display the frequency. There are three operating functions - automatic frequency ranging, manual frequency ranging, and self-check. Signals are applied to the

counter through input BNC connectors, either AC or DC coupled; there is an input signal Sensitivity control and an input signal Slope selector. The frequency is displayed on five decimal gaseous discharge indicators; there is an overrange unit's digit. All readings are directly in Hertz with a decimal point indicator. An Off-Scale indication is provided in the manual modes to indicate incorrect selection of scale. A Display Time control varies the duration of the indication.

3.3.1. INPUT CONNECTIONS AND CONTROLS

The use and operation of the input connections and controls are identical to the functions on the Model 301 as described in paragraph 3.2.2.

3.3.2. SELECTION OPERATING MODE AND FREQUENCY RANGE

The Function Selector switch SW2 may be placed in the Automatic position; in which case the counter automatically indexes to the most suitable range for the measurement of the frequency of the signal attached at the input. The automatic ranging provides a minimum reading on any scale of 10000. If the frequency is lower than this number, the counter automatically indexes to the next lowest scale. In this mode of operation, the Range Selector switch is inoperative. The counter operates in the Manual mode by placing the Function Selector switch in the Manual position, in which case the operator selects the most suitable range for the frequency measurement. There are five decade ranges, covering the frequencies from 1 to 100,000 Hz. Each range can display one-half the lowest nominal reading and two times the highest nominal reading; thus the lowest range indicates frequencies from 0.5 to 20 Hz, etc.

3.3.3. REAR PANELS CONTROLS AND CONNECTIONS

The internal operating clock frequency is 2MHz. This frequency divided by 2 is made available at connector J2 on the rear panel for calibration purposes. The user may apply his own external clock at 2 MHz through connector J5. This signal should be compatible with RTL logic, having a voltage swing from 0 to approximately 1.5 volts or greater. Signals having a peak to peak voltage swing greater than 20 volts should not be applied to this connector. The remote range control is not available in the Model 301, however, remote signals may be applied to TB1 as in the case of other models in this series.

3.4. MODEL 302 (See Figure 3-3)

The Model 302 Frequency Counter may be placed into operation and employed in precisely the same manner as the Model 301. The Model 302 has additional operating functions in which the frequency is counted as the number of times the signal passes through a given amplitude point in a unit time. This mode of operation is indicated as the Axis-Crossing Frequency mode on the Function Selector switch. Additionally, the Period of the input signal may be measured by selecting the Period position on the Function Selector switch.

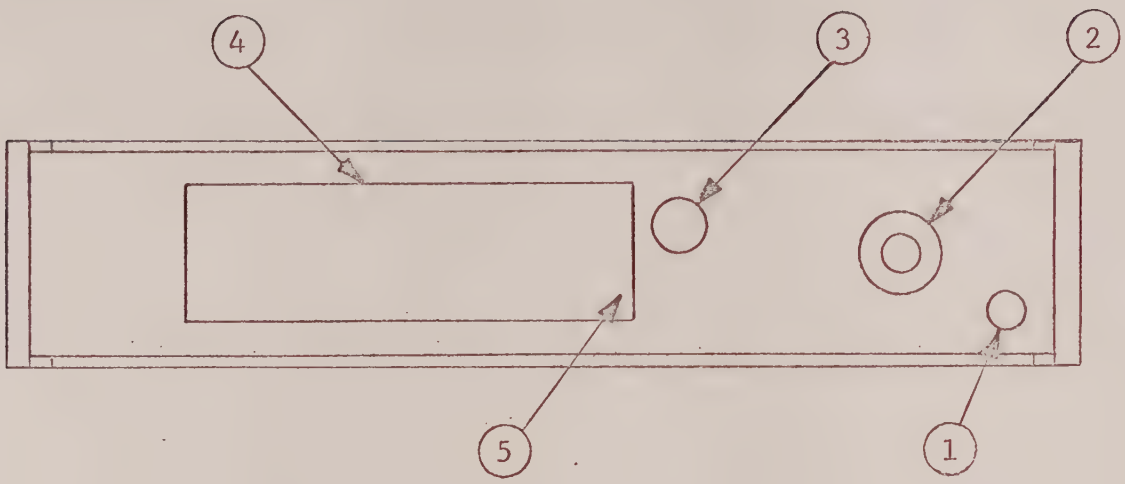
The signal is applied to either of the input connectors on the front panel or through TB1 on the rear panel as described above. The appropriate function may be selected through the Function Selector switch. The Computed Frequency modes and Self-Check modes perform in the manner described above, having either a remote (rear panel) or front panel Range selection.

3.4.1. AXIS-CROSSING FREQUENCY MEASUREMENT

In the Axis-Crossing Frequency function the time base may be selected on the Range Selector switch as 0.01 second, 0.1 second, 1.0 or 10 seconds. If the Function Selector switch is placed in the Axis-Crossing Frequency position and the Range Selector switch is placed in Remote, then a 1 second time base is used. The unit's indicator automatically shows the correct unit, and the decimal point indicator is positioned in accordance with the time base selected. When the unit's indicator flashes, an updated reading is given.

3.4.2. PERIOD MEASUREMENT

When the Function Selector switch is placed in the Period function, the Range Selector may be placed in any one of four positions, which measures the duration of the period directly or the duration of 10 periods, 100 or 1000 periods. The choice of range is determined by the resolution desired by the user. Since the minimum resolution is 1μsecond greater resolution in period measurement is obtainable for the high frequency signals if a multiplicity of periods is measured. In the Remote position the period measurement multiplier is automatically selected as X1 when position TB1-3 is connected to the Return, X10 when position TB1-4 is connected to the Return, and so on. Thus, when the Model 302 is used with a Weston Oscillator on the remote ranges, the scale is automatically selected as that which gives the most resolution.



FREQUENCY COUNTER, MODEL 300

1. POWER ON-OFF switch (SW3), turns power on or off.

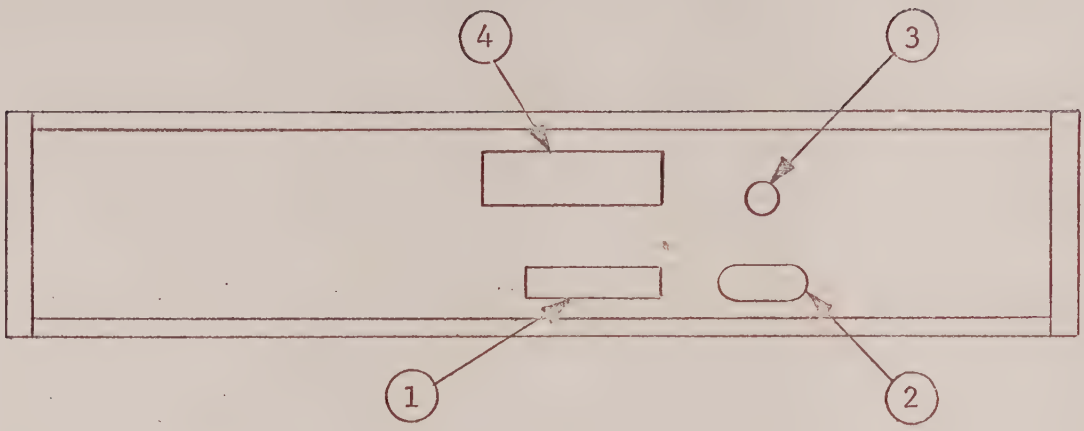
2. FUNCTION SELECTOR switch (SW2), selects operating mode. Self-Checking; Computed Frequency, 10Hz - 100kHz.

3. DISPLAY TIME control (R1), controls the duration of the display. Full clockwise rotation causes permanent storage of data, full counter-clockwise rotation provides minimum storage time.

4. NUMERICAL DISPLAY, a maximum display of 199,999 by means of five "0" through "9" visual indicators and one overrange indicator (display "1" only). Decimal point automatically positioned.

5. UNITS INDICATOR, displays scale factor of the numerical display. The units indicator turns on immediately prior to a measurement.

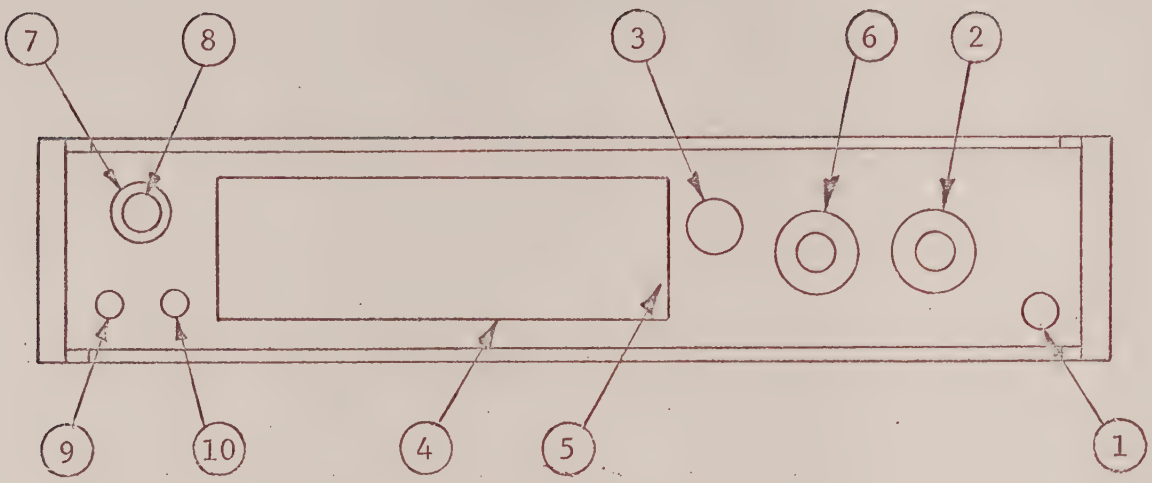
FIGURE 3-1A, FRONT PANEL OPERATING CONDITIONS



FREQUENCY COUNTER, MODEL 300

1. REMOTE INPUT SIGNAL AND RANGE CONTROL (TB1).
2. AC LINE RECEPTACLE (J1).
3. AC LINE FUSE.
4. MULTIPIN CONNECTOR (J6), for optional read-out.

FIGURE 3-1B, REAR PANEL CONTROLS



FREQUENCY COUNTER, MODEL 301

1. POWER ON-OFF switch (SW3), turns power on or off.

2. FUNCTION SELECTOR switch (SW2), selects operating mode. Self-Checking; Computed Frequency.

3. DISPLAY TIME control (R1), controls the duration of the display. Full clockwise rotation causes permanent storage of data, full counter-clockwise rotation provides minimum storage time.

4. NUMERICAL DISPLAY, a maximum display of 199,999 by means of five "0" through "9" visual indicators and one overrange indicator (display "1" only). Decimal point automatically positioned.

5. UNITS INDICATOR, displays scale factor of the numerical display. The units indicator turns on immediately prior to a measurement.

6. RANGE SELECTOR switch (SW1), selects range for measurement, or selects remote operation of range.

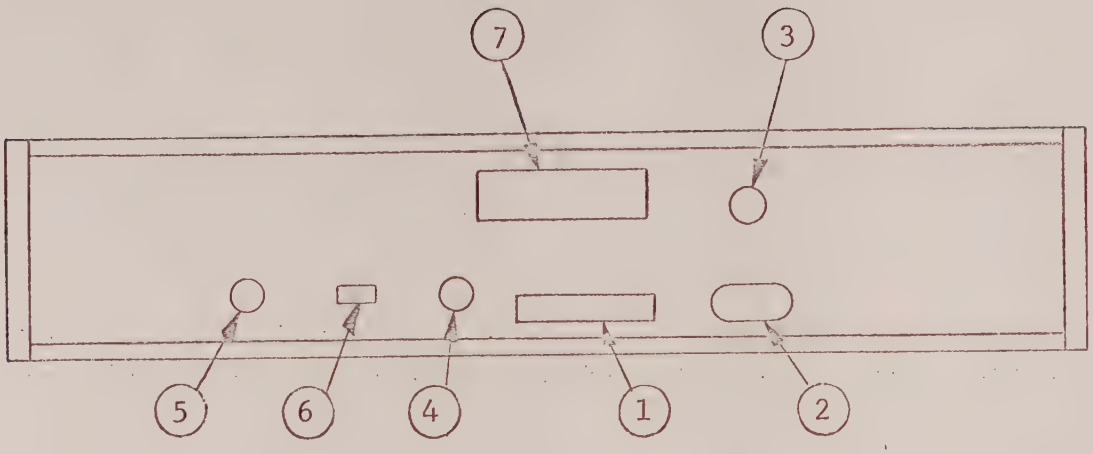
7. SLOPE SELECTOR (SW6), selects positive or negative edge to trigger measurement.

8. SENSITIVITY CONTROL (R2), used to adjust the input signal level to that minimum level which causes reliable counting.

9. INPUT CONNECTOR: DC coupled (J3).

10. INPUT CONNECTOR: AC coupled (J4), for signals with DC components greater than 1/10 peak AC value.

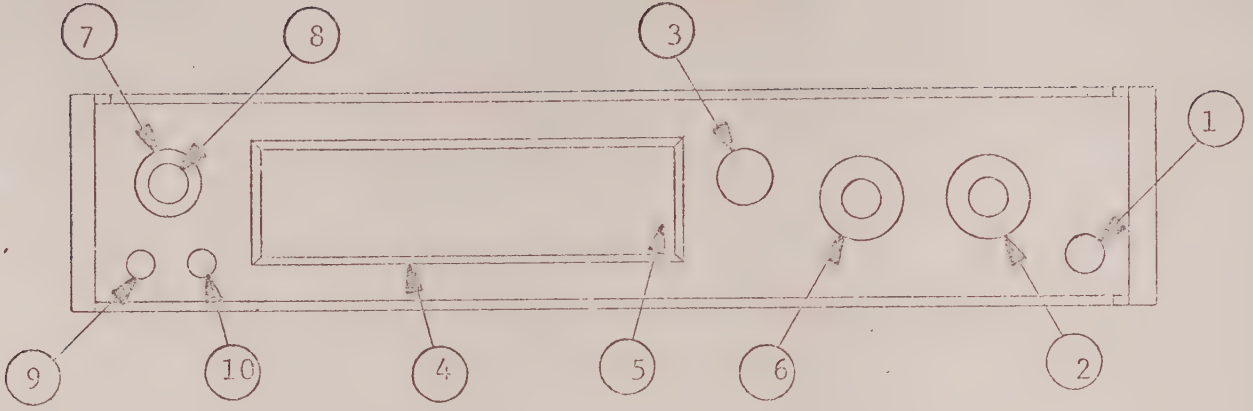
FIGURE 3-2A, FRONT PANEL OPERATING CONTROLS



FREQUENCY COUNTER, MODEL 301

1. REMOTE INPUT SIGNAL AND RANGE CONTROL (TB1).
2. AC LINE RECEPTACLE (J1).
3. AC LINE FUSE.
4. 1MHz CLOCK OUTPUT (J2).
5. 2MHz EXTERNAL CLOCK INPUT (J5).
6. INT-EXT CLOCK SELECTOR (SW6).
7. MULTI-PIN CONNECTOR (J6) FOR OPTIONAL READ-OUT.

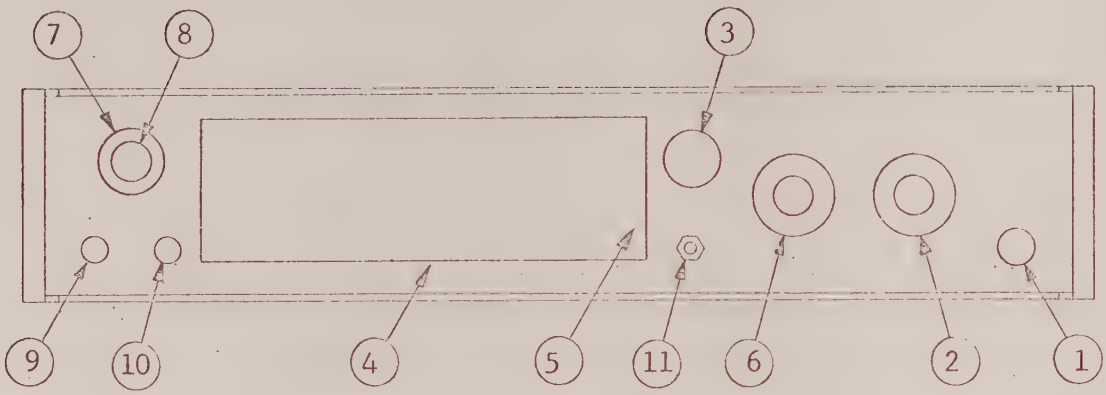
FIGURE 3-2B, REAR PANEL CONTROLS



FREQUENCY COUNTER, MODEL 301C

1. POWER ON-OFF switch (SW3), turns power on or off.
2. FUNCTION SELECTOR switch (SW2), selects operating mode. Computed (Reciprocal) Frequency-Automatic Ranging; Compute Frequency-Manual Ranging; Self-Check.
3. DISPLAY TIME control (R1), controls the duration of the display. Full clockwise rotation causes permanent storage of data, full counter-clockwise rotation provides minimum storage time.
4. NUMERICAL DISPLAY, a maximum display of 199,999 by means of five "0" through "9" visual indicators and one overrange indicator (display "1" only). Decimal point automatically positioned.
5. UNITS INDICATOR, displays scale factor of the numerical display. The units indicator turns on immediately prior to a measurement.
6. RANGE SELECTOR switch (SW1), selects one of five frequency ranges for Manual operation. 1-10, 10-100, 100-1000, 1000-10000, 10K-100K, Hertz.
7. SLOPE SELECTOR (SW5), selects positive or negative edge to trigger measurement.
8. SENSITIVITY CONTROL (R2), used to adjust the input signal level to that minimum level which causes reliable counting.
9. INPUT CONNECTOR: DC coupled (J3).
10. INPUT CONNECTOR: AC coupled (J4), for signals with DC components greater than 1/10 peak AC value.
11. RESET switch (SW7), sets counter to zero.

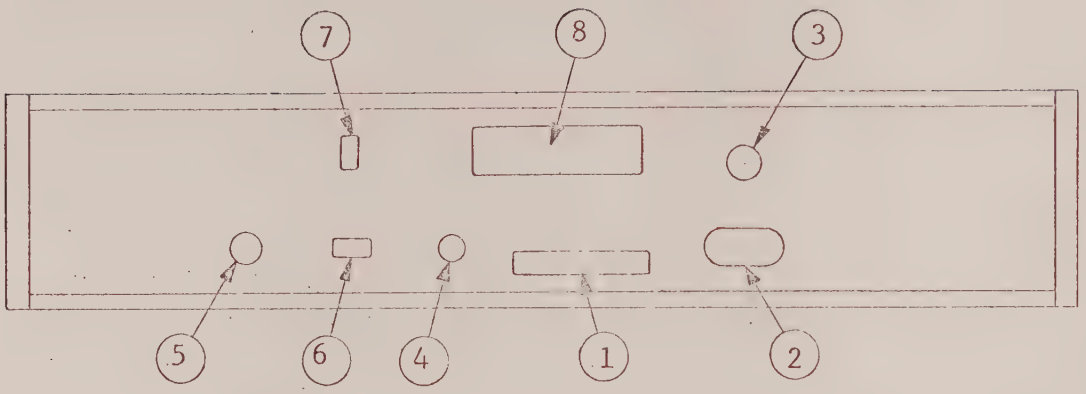
FIGURE 3-3A, FRONT PANEL OPERATING CONTROLS



FREQUENCY COUNTER, MODEL 302

1. POWER ON-OFF switch (SW3), turns power on or off.
2. FUNCTION SELECTOR switch (SW2), selects operating mode. Self-Checking; Computed Frequency, 10Hz - 100kHz or 1Hz - 10kHz; Axis-crossing frequency, or Period.
3. DISPLAY TIME control (R1), controls the duration of the display. Full clockwise rotation causes permanent storage of data, full counter-clockwise rotation provides minimum storage time.
4. NUMERICAL DISPLAY, a maximum display of 199,999 by means of five "0" through "9" visual indicators and one overrange indicator (display "1" only). Decimal point automatically positioned.
5. UNITS INDICATOR, displays scale factor of the numerical display. The units indicator turns on immediately prior to a measurement.
6. RANGE SELECTOR switch (SW1), selects range for measurement, or selects remote operation of range.
7. SLOPE SELECTOR (SW6), selects positive or negative edge to trigger measurement.
8. SENSITIVITY CONTROL (R2), used to adjust the input signal level to that minimum level which causes reliable counting.
9. INPUT CONNECTOR: DC coupled (J3).
10. INPUT CONNECTOR: AC coupled (J4), for signals with DC components greater than 1/10 peak AC value.
11. RESET switch (SW7), sets counter to zero.

FIGURE 3-3A, FRONT PANEL OPERATING CONTROLS



FREQUENCY COUNTER, MODEL 302

1. REMOTE INPUT SIGNAL AND RANGE CONTROL (TB1).
2. AC LINE RECEPTACLE (J1).
3. AC LINE FUSE.
4. 1 MHz CLOCK OUTPUT (J2).
5. 2 MHz EXTERNAL CLOCK INPUT (J5).*
6. INT-EXT CLOCK SELECTOR (SW6)
7. COUNT DISPLAY switch (SW9), allows count to be displayed.
8. MULTIPIN CONNECTOR (J6) for optional read-out.

*Approximately 1000 ohms input resistance, levels compatible with RTL logic (swing from 0 to + 1.5 volts) not greater than 10 volts peak to peak.

FIGURE 3-3B, REAR PANEL CONTROLS

SECTION 4

THEORY OF OPERATION

Most frequency counters determine frequency as the number of times (N) a periodic signal passes through a reference voltage with a given slope in a unit time; resolution is thus limited by the number N, and, since the unit time duration may be established accurately, the accuracy of the measurement is limited only by the resolution. If the rate of occurrence is low, in order to increase resolution and hence, accuracy, a long time base is used. Often, if the rate is low, rather than measure N, the time interval between like slopes, axis-crossings are measured. Then the resolution in measuring is limited to the frequency of the clock that may be used for the purpose; however, in this case, the "period" has been measured, not the frequency. If the period can be converted into a frequency with a precision equal to the measurement of the period, then it is possible to compute the frequency of a low-frequency signal with high resolution and thus a high accuracy (assuming the clock to be accurate). The Model 300 Series Frequency Counters accomplish this task.

4.1. BLOCK DIAGRAM

The structure of the Counter is shown in Figure 4-1 in block diagram form. An input signal is applied to Timing and Control which generates the T Count Control, lasting for a time equal to the interval between successive axis crossings of the input and synchronized to a very high frequency clock. This signal turns on And Gate No. 1., allowing the clock to be counted by the T Counter which accumulates a number of pulses proportional to the duration of the successive axis crossings.

Waveforms are shown in Figure 4-2. Immediately after the end of T Count Control, Timing and Control generates the TF Count Control, which is applied to And Gate No. 2, allowing clock pulses to be applied to the F Scaler and Counter. The F Scaler and Counter has outputs (rates) from each counting element which are applied to a Rate Multiplier. The Rate Multiplier also has applied to it, from the T Counter, signals which control (enable or inhibit) the summation of all of the F Counter

rates. The pulses constituting these rates are added at the output of the Rate Multiplier to produce a signal having the composite rate. The manner in which the controls are connected is such as to cause the composite rate to be the product of the fixed clock frequency and the number in the T Counter.

The Rate Multiplier output is counted by the TF Rate Counter which generates a control signal when the integrated rate exceeds a certain fixed value. The F Scaler and Counter at this point has accumulated that number of clock pulses which when multiplied by the period is a constant; this number is a scaled multiple of the frequency. A trigger may now be used to repeat the process.

What has been done in this process is to determine that number of clock pulses which when multiplied by the period T, has a value of unity (where unity is represented by the number of counts it takes to make the TF Rate Counter have one carry). Thus, the number of clock pulses corresponds to frequency, or the equation

$$FT = 1$$

is solved.

4:2. LOGICAL INTERCONNECTIONS

A more detailed discussion of the Frequency Counter and its method of operation is provided by reference to Figure 4-3, the simplified logic diagram of the Frequency Counter. The input signal is applied through a Selectable Decade Scaler to Timing and Control. The Selectable Decade Scaler causes any periodic signal to be scaled into one decade frequency range. It may be seen that the Frequency Counter has upper and lower limits of operation, which are determined by the size of the T Counter and the F Counter-Scaler; the Decade Scaler converts the frequency to this frequency range.

4.2.1. T-COUNTER

As was discussed above, the T Count Control enables a gate to allow 2 MHz clock pulses to pass to the T Counter. The T Counter is set initially to zero. The T Counter has five decade counting stages followed by two binary stages (a binary stage being indicated by [1] , and a decade stage by [9] in Figure 4-3), so that a total count can be accumulated of 399,999 pulses before the T Counter recycles. Therefore, if the T Count Control is on for exactly 0.2 second, a clock frequency of 2 MHz

will cause 400,000 pulses to pass into the T Counter, which is just sufficient to cause it to recycle once. Thus, any period of time less than 0.2 second (5 Hz) will allow the T Counter to accumulate a measurable number of clock pulses. For instance, in 0.1 second, the T Counter will accumulate 200,000 pulses (corresponding to 10 Hz), whereas in 0.01 second the T Counter will have accumulated 20,000 pulses (corresponding to 100 Hz).

After the T Count Control signal is turned off, the T Counter holds the number of clock pulses counted in the T period, which is a measure of the periodic input signal.

4.2.2. F-COUNTER

Thereafter, the clock frequency is applied through And Gate 2 to the F Scaler and Counter. The F Scaler and Counter consists of two binary and five decade scaling elements (each binary element being designated by the number [1] , and each decade being designated by the number [9] in Figure 4-3. A 2 MHz clock pulse is applied to the first stage of the F Scaler and Counter and its output is at a rate of 1 MHz. This output is applied to the next binary scale which produces an output at a rate of 0.5 MHz. This is applied to the first decade scaler which has an output at 50 kHz and so on, each decade scaler applying its output to the next scaler in line. Additionally, outputs are conducted to the Rate Multiplier from each binary element of the decade scaler of the F Scaler and Counter; these rates occur at rates determined by the position of the scaler element in the chain. For instance, the first element produces a rate of 1 MHz; the second of 0.5 MHz. Four lines are shown coming from the first decade scaler, representing the outputs from the 1, 2, 4, 8 stages within the decade, and having rate outputs of 250, 100, 50 and 50 kHz respectively.

4.2.3. RATE MULTIPLIER

The Rate Multiplier functions to produce a rate at its output which is the product of the clock rate and the number stored in the T Counter. Figures 4-4, 4-5 and 4-6 illustrate how the Rate Multiplier generates a variable rate signal under the control of the T Counter. Figure 4-4 shows schematically the elements of the F Counter, T Counter and Rate Multiplier associated with the generation of the highest rates. Figure 4-5 shows the timing of the signals in Figure 4-4. In Figure 4-5 are shown the different carry output signals of the elements of the F Counter. The elements (flip-flops) of the decade scale of the F Counter are arranged to count in a 1-2-4-8 code. The

states of the 1-2-4-8 flip-flop outputs are shown in Figure 4-5 as the "carry outputs" of 1-2-4-8 scalers of the first decade. The rate outputs are the pulses that occur at the negative-trailing edges of the respective outputs; shown as the pulse patterns of Figure 4-5, "rate outputs". The rate output of the first binary stage is 1 MHz; the rate output of the second binary stage is 500 kHz. The rate output of the first stage of the decade scaler is 250 kHz. Since the second stage of the F Counter decade has two negative-going edges per 50 kHz cycle, it appears to have an average rate output of 100 kHz. Similarly, since the "4" output scaler and the "8" output scaler have only one negative-going edge per 50 kHz cycle, it appears as if the average frequency of these two counting elements is 50 kHz.

The rate outputs are conducted to gates. The capacitors and resistors are the means of obtaining a negative-going pulse at the negative-trailing edge. The gates of the Rate Multiplier are And Gates in which two negative signals are required to have a positive output (for the And function). The state of the elements (flip-flops) of the T Counter control the gates and consequently the rate. The most significant binary stage in the T Counter controls the least significant binary stage in the F Counter; the most significant decade of the T Counter is controlling the least significant decade of the F Counter, and so forth. Within each decade, there is a logical interconnection between the elements of the T Counter and the elements of the F Counter.

The manner in which the Rate Multiplier generates a variable rate is illustrated in Figure 4-6, in which the top-most pulse train represents a rate which has been obtained by allowing the outputs of the first and second binary stages to pass and all other rates to be inhibited. In this event, it would appear that every two microseconds, three pulses are generated, which corresponds to an average rate of 1.5 MHz. On the other hand, if only the output of the 8's stage of the first F Counter decade is allowed to pass through the Rate Multiplier, an extra pulse (shown in circle) occurs once every 20 microseconds and an average rate of 1.55 MHz appears to have occurred. Likewise, if in addition to this the 2's stage of the first decade of the F Counter is added to the above pattern, an average rate of 1.65 MHz appears to occur. By combining the several rates, it is clear that it is possible to obtain any desired rate from 50 kHz to 2 MHz in 50 kHz intervals, and since the pulse patterns are not regular, this rate is obtained only on the average of a 50 kHz cycle (or every 20 microseconds).

By extending the controls to the next decade stage of the F Counter Scaler which has an output of 5 kHz, it is intuitively clear that it is possible to obtain any rate from 5 kHz to 2 MHz in 5 kHz steps, and so forth. In fact, referring to Figure 4-3, it is possible to obtain any rate at the output of the Rate Multiplier from 5 Hz to 2 MHz in increments of 5 Hz.

The only remaining facet of the operation of the Rate Multiplier is the code used to count the period. It must be such that when stored in the T Counter, the controls applied to the rate multiplier gates must control the rate in direct proportion to the number in the T Counter. For instance, if the 50 kHz rate referred to above is obtained, it is obtained because the number in the T Counter is one fortieth of the maximum number. If the 250 kHz rate referred to above is obtained, it is the result of the number in the T Counter being one eighth of the maximum, and so forth. A table of this particular requirement reveals that the code for the T Counter is 1-2-1-5 and the gates shown in the T Counter generate this code.

4.2.4. T-F COUNTER AND NUMERICAL EXAMPLES

As an example, if the T Counter registered a number in which the most significant binary digit was 1 and all other elements 0 (i.e., 200,000 pulses, corresponding to a 0.1 second period), only the rate of the least significant digit of the F Scaler (1 MHz) would be allowed to pass through the Rate Multiplier to the TF Rate Counter. The TF Rate Counter contains one binary and four decade scalers, and since the rate from the Rate Multiplier is at 1,000,000 Hz, the TF Rate Counter produces a carry after 0.02 second. In that time, 40,000 pulses would have been applied to the F Counter, and after scaling through the first two binary stages, 10,000 pulses would have been applied to the five decade stages of the F Counter. Thus the decade stages of the F Counter would contain the number 10,000 (i.e., 10.000). This is, however, precisely the frequency of the applied signal, since the applied signal had a period of 0.1 second, as was discussed above.

If the period is 0.01 second (corresponding to 100 Hz), the T Counter stores the number 20,000. The last decade of the T Counter stores the number "2". It controls the rate output of the 2's flip-flop of the first F Counter decade, generating a rate of 100,000 Hz. The TF Counter has one carry in 0.2 seconds, and the F Counter counts 400,000 pulses, storing the number 100,000 (i.e., 100.000) in the five decades of the F Counter (there is an over-flow binary storage element for this purpose

shown in Figure 4-3). Thus the frequency 100.000 Hz has been measured.

The number counted by the F Counter is transferred upon a Strobe command from the Timing and Control to a storage which is in turn used to activate decade visual display devices as shown in Figure 4-3.

4.3. MEASUREMENT TIME AND ACCURACY

From the above, the measurement of the period is accomplished on each range as described in Table 4-1 below.

Table 4-1

	Frequency (Hz)	Count Stored in T Counter	Period (Sec)
Highest Indication	200	10,000	0.005
Highest Nominal Frequency	100	20,000	0.010
Lowest Nominal Frequency	10	200,000	0.100
Lowest Indication	5	400,000	0.200

At 100 Hz the period is measured to within $\pm$ 1/2 count in 20,000 or 0.0025% (the poorest resolution). The variable TF Rate pulses are counted to 20,000 in a time γ shown in Table 4-2 below. Although not discussed before, the irregular TF pulse rate causes the F counter to finalize its count in steps which may correspond to several clock pulses. This irregularity varies with indicated frequency as shown below. Table 4-2 shows the total time to make a measurement and the total resolution as a function of frequency.

Table 4-2

Frequency (Hz)	Period (sec)	$\mathcal{T}$ (sec)	Total Measure-ment Time (sec)	Period Resolu-tion(%)	Frequency Irregu-larity(%)	Total Resolu-tion Error
200	0.005	0.40	0.405	0.005	0.005	0.010
100	0.010	0.20	0.21	0.0025	0.005	0.0075
10	0.100	0.02	0.12	0.00025	0.005	0.0052
5	0.200	0.01	0.21	0.00012	0.02	0.0201

It can be seen, over the nominal range 10-100 Hz, that the maximum measurement time is 0.21 second, increasing to 0.405 above the nominal range at 200 Hz. However, 200 Hz may be read on the next highest scale in a time of 0.09 second. The resolution over the nominal range varies from 0.0052% to 0.0075%. The crystal controlling the clock frequency maintains $\pm$ 0.0025% stability over the temperature range 0-60°C. This yields an over-all accuracy of $\pm$ 0.0077% for measurements at the lowest nominal frequency, 10 Hz, and 0.01% for the highest nominal frequency, 100 Hz.

4.4. CALIBRATION

The Frequency Counter is completely calibrated at the factory. No further calibration should be required other than that which is a part of a periodic maintenance program.

There are three calibration adjustments:

1. R10 on component board 7B (see Schematic 04-126-509) adjusts the +3.6 volt power supply.

2. R2 on component board 1A (see Schematic 04-126-513) adjusts the DC threshold level of the input axis-crossing detector.

3. C5 on component board 7B (see Schematic 04-126-509) adjusts the frequency of the internal clock.

Adjustments require the removal of the top cover.

4.4.1. 3.6 VOLT DC POWER SUPPLY ADJUSTMENT

Connect a Weston Model 80 Volt Ohm Meter from TP1 to TP2 (Gnd) on component board 7B. Adjust R10 on component board 7B to cause the meter to read 3.6 volts. Remove the meter.

4.4.2. INPUT DC THRESHOLD LEVEL ADJUSTMENT

Apply a 100 Hz sine wave from a signal source (Weston CVO-100 Oscillator or equivalent) to either the front panel DC Input BNC, or TB1 positions 1 and 2. (For the Models 301 and 302, the most convenient connection is through the front panel; for the Model 300 it is through TB1.) If the former, place the Range Selector switch in the "1" position of Number of Cycles Counted and turn the Sensitivity control full clockwise; if the latter, place the Range Selector switch in Remote (for Models 301 or 302 only). Place the Function switch in the Computed Frequency position.

Connect a high impedance oscilloscope probe between TP6 on component board 1A and TP1 (Gnd). The oscilloscope may be internally triggered and set to a scale of 1 volt per centimeter (approximately). The time base may be set to provide a full sweep of 20 milliseconds. With an input signal magnitude of 10 volts rms (approximately), a square or symmetrical train of pulses should appear (the voltage being at +1.5 to 2 volts or at 0 to 0.25 volts for equal time in each cycle). Reduce the amplitude of the sine wave, observing the symmetry of the square wave; if it becomes unsymmetrical, adjust R2 to restore the symmetry. Repeat the adjustment for smaller and smaller amplitudes until the input signal is too small to cause triggering. The observed signal should be approximately (within 10%) symmetrical for that signal level which is 10% greater than the value just sufficient to cause triggering.

After this calibration, all equipment may be disconnected.

4.4.3. INTERNAL CLOCK FREQUENCY ADJUSTMENT
(Allow 1-Hour Warmup Time)

Connect an external counter to connector J2 (on Model 300 remove top cover and connect between GND, TP4, and, TP3, on power supply. 7P, board - see location diagram), on the rear panel.

Place SW5 on the rear panel in the INT clock position. The external counter to be used should have a precision sufficient to measure a 1 MHZ signal to within 1 part in 10^7.

The external counter should read 10000000 $\pm$ 1 HZ. Adjust C5 on component board 7B to obtain this reading.

The Model 300, 301 or 302 is calibrated after these adjustments. A further check on its operation may be made by placing the Function switch in the "Self Check" position. Due to the bunching effect of the rate multiplier, the final computed frequency has a rounding error which is within the accuracy specifications. This rounding is noticeable in the "Self-Check" position, and the sequence of numbers is 99996, 1000000, 100010, etc. A reading of 99996 or 1000000 indicates correct operation. (6 "nines" option a reading of 100002 also indicates correct operation).

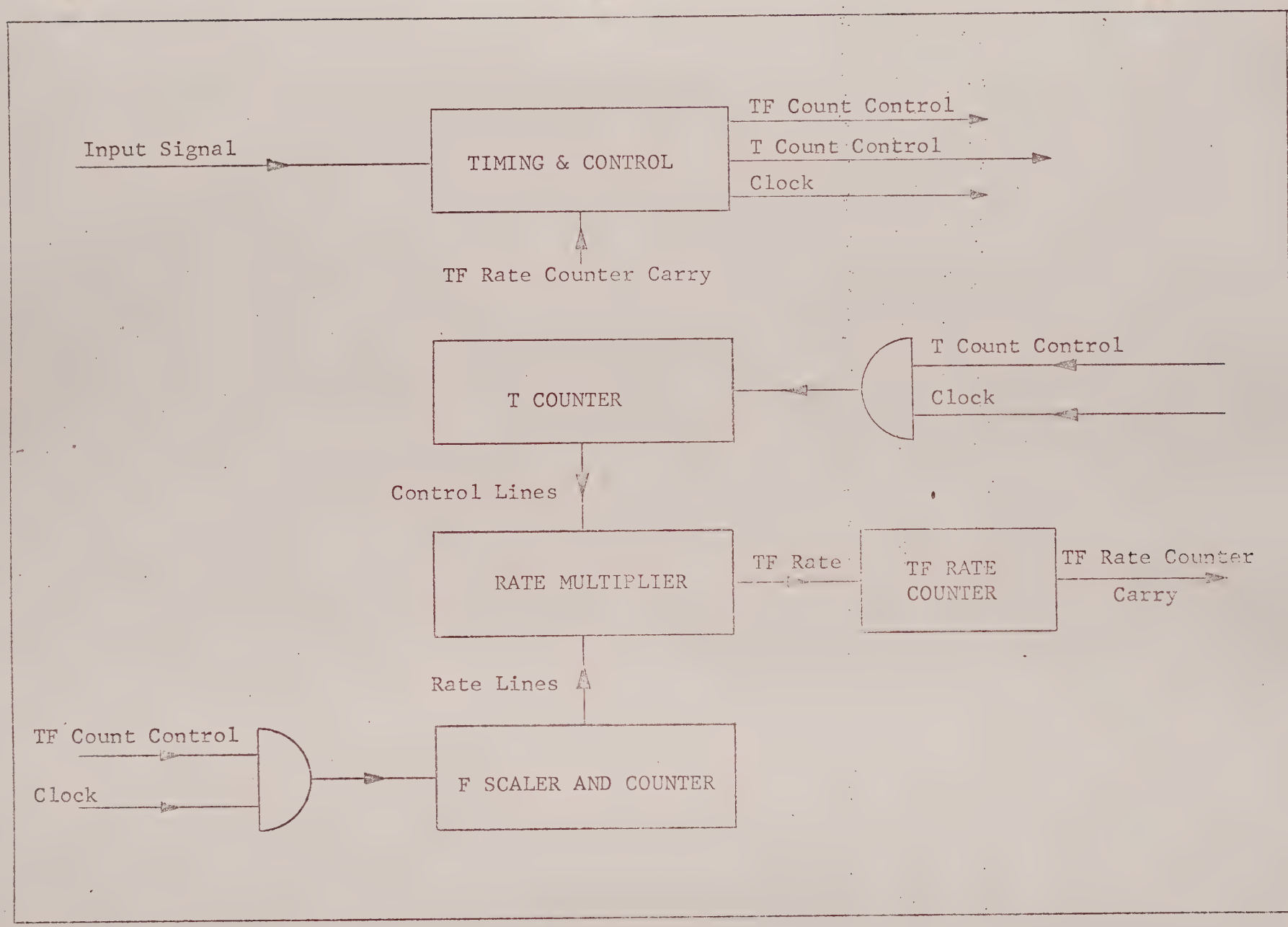


FIGURE 4-1
Block Diagram Frequency Counter

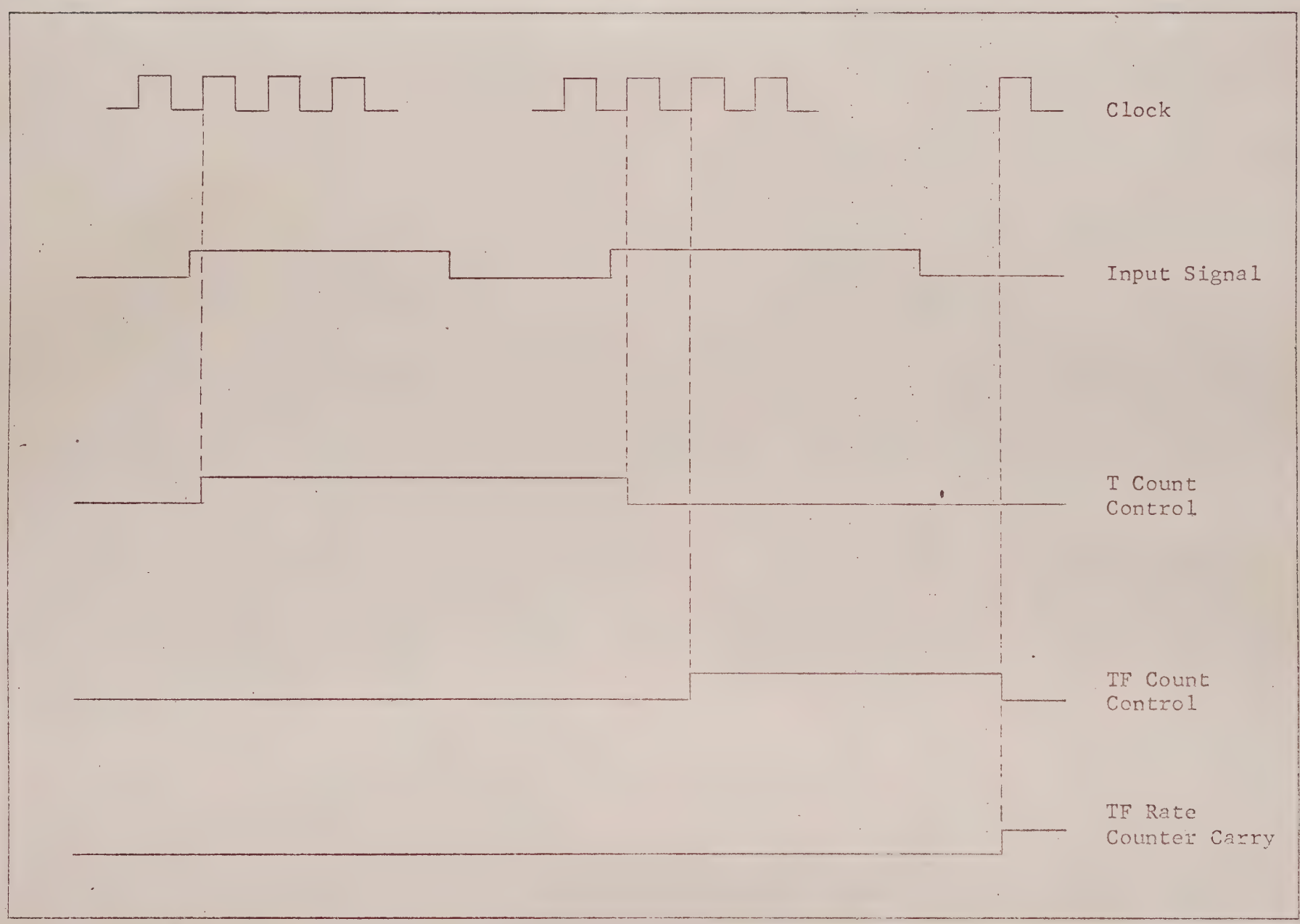


FIGURE 4-2
Timing Diagram Frequency Counter

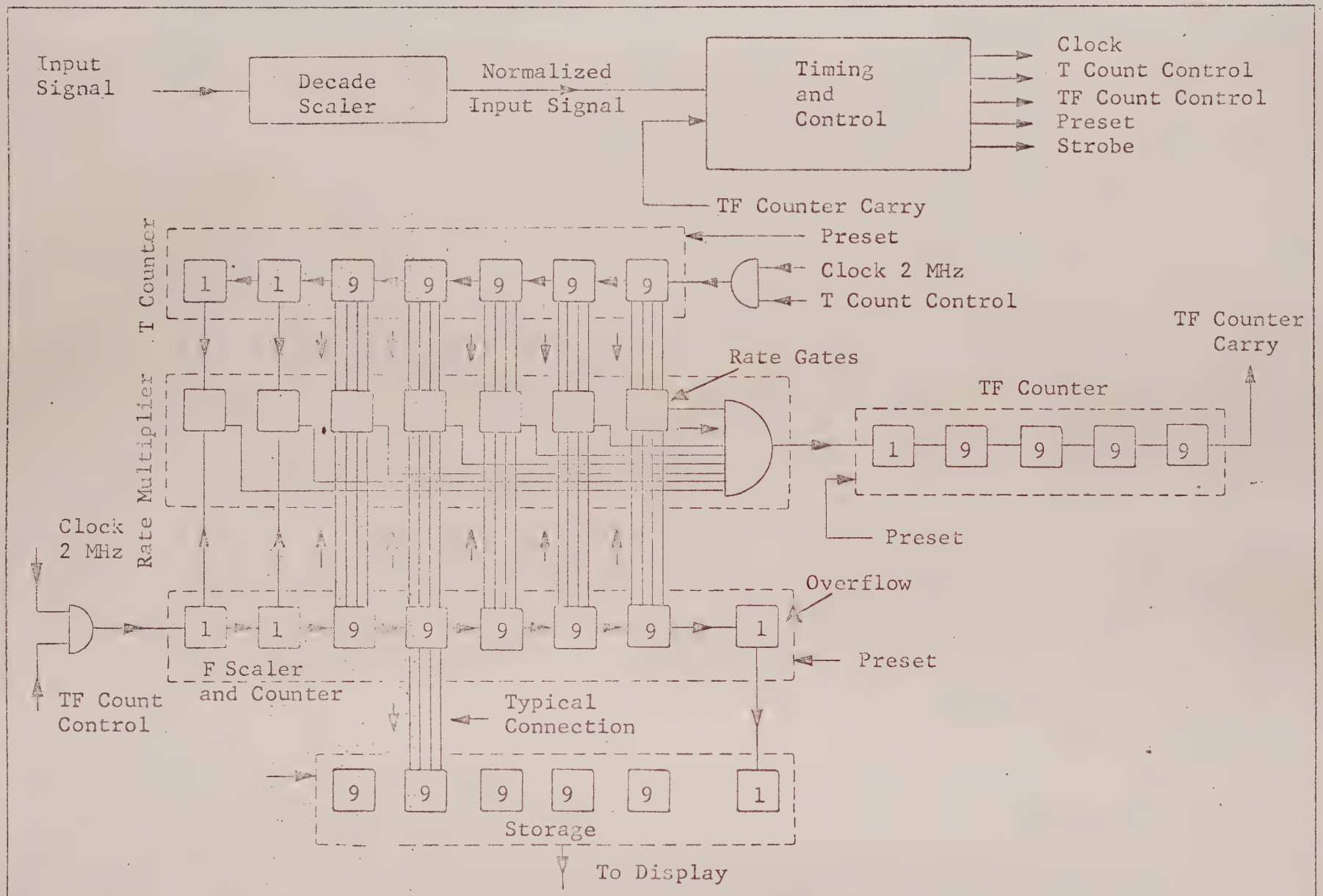


FIGURE 4-3
Logic Diagram Frequency Counter

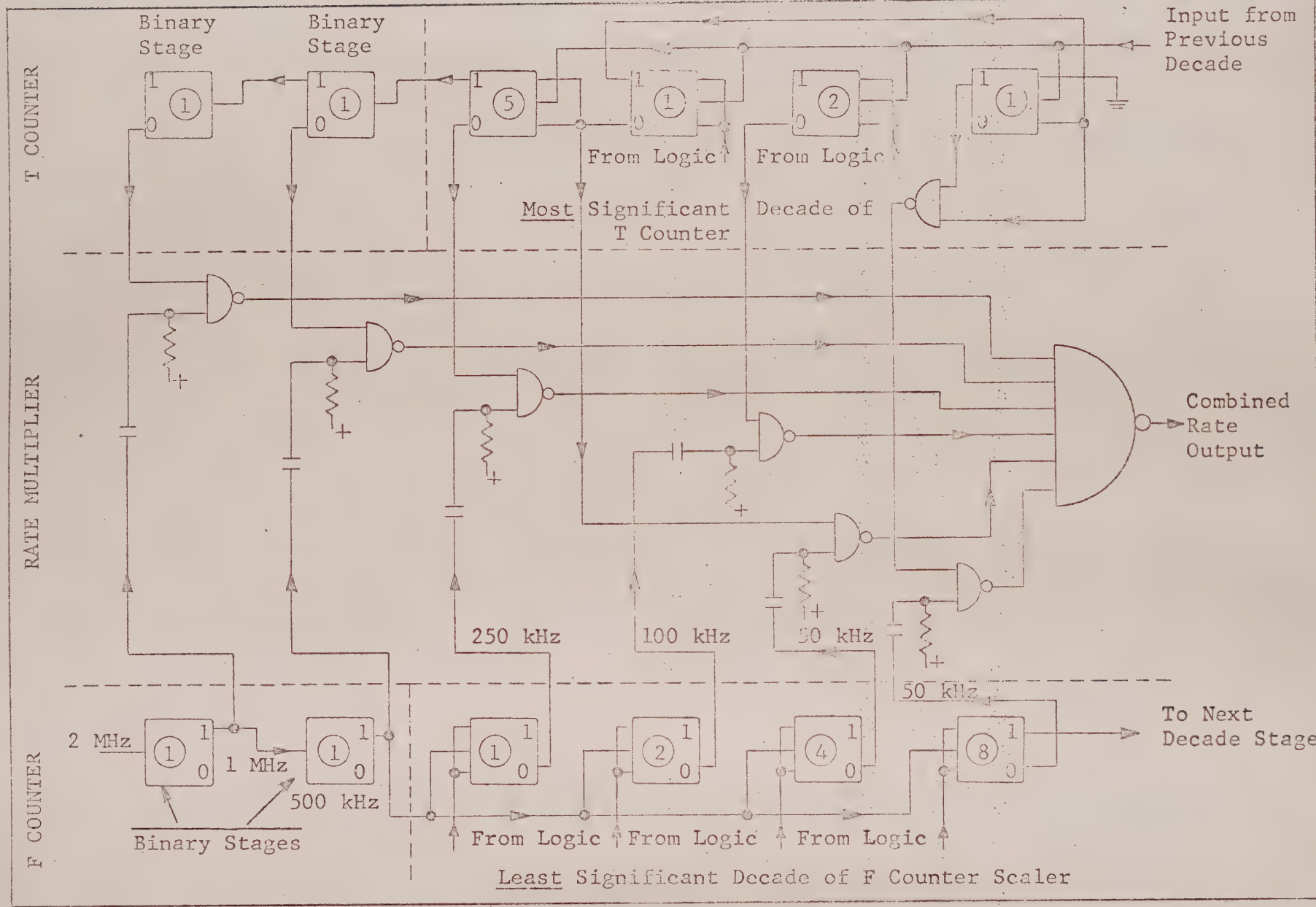


FIGURE 4-4
Rate Multiplication Logic

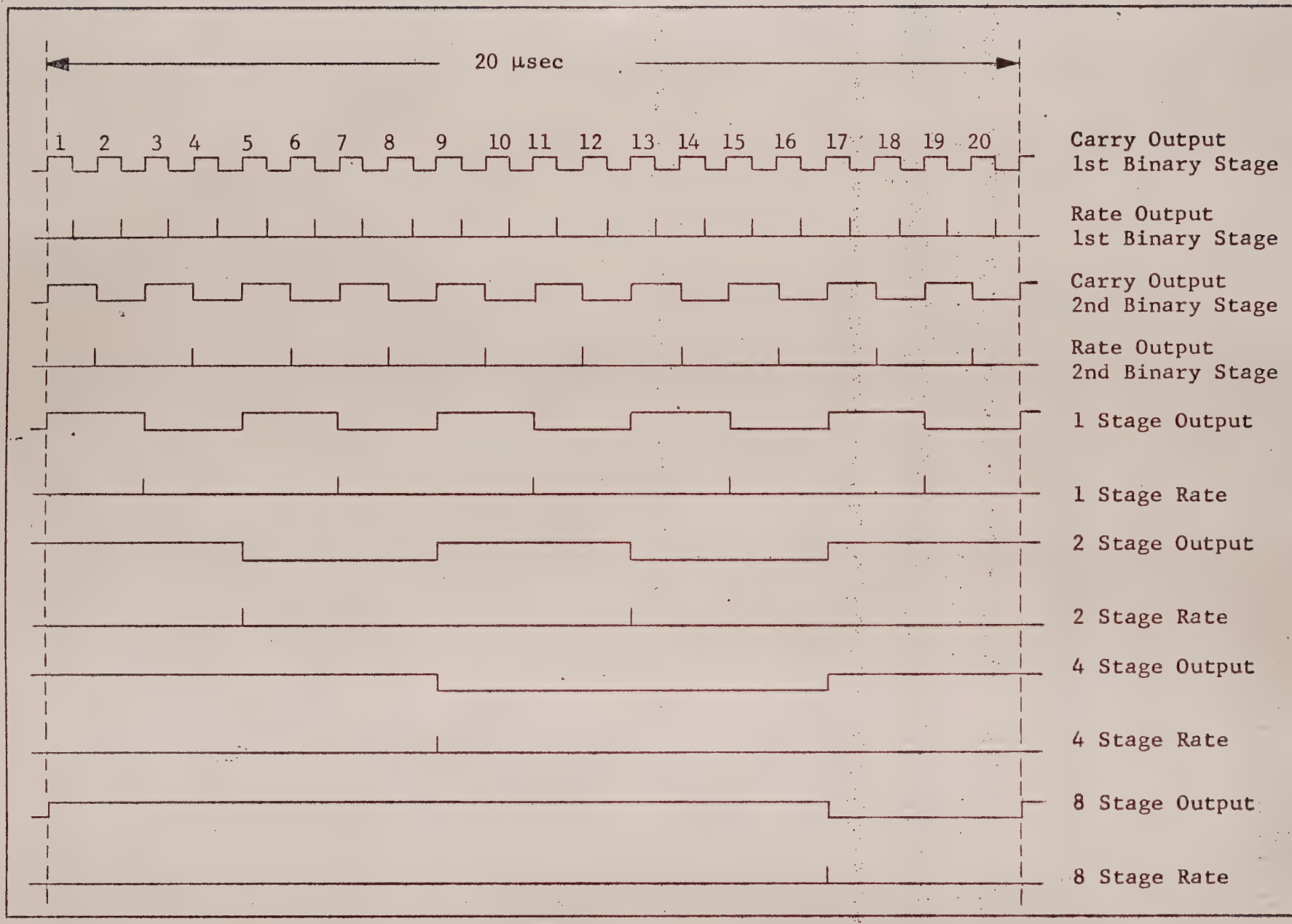


FIGURE 4-5
Rates and Timing of F Scaler - 1st and 2nd Binary and First Decade Stages

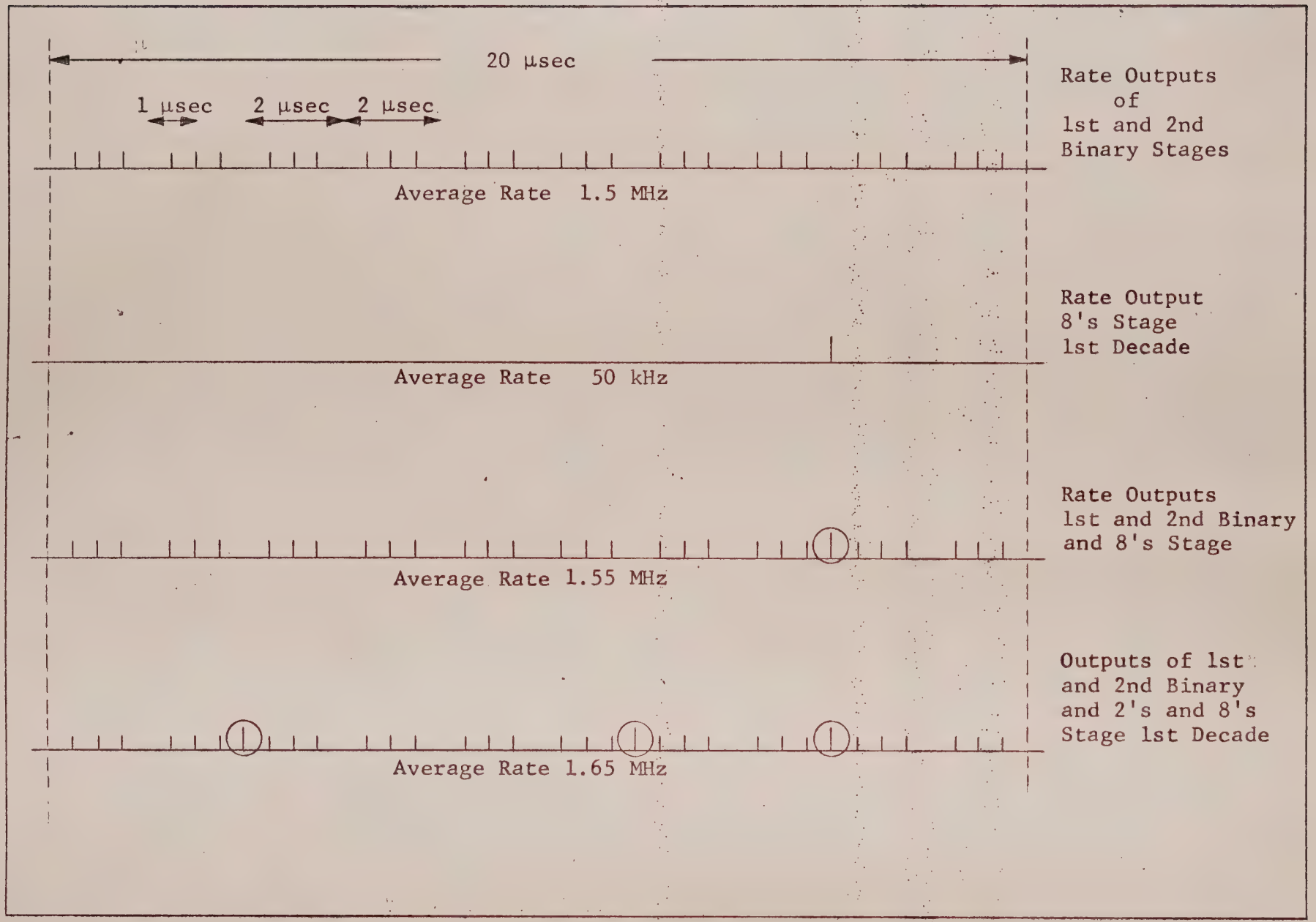

20 µsec
1 µsec
2 µsec
2 µsec
Rate Outputs of 1st and 2nd Binary Stages
Average Rate 1.5 MHz
Rate Output 8's Stage 1st Decade
Average Rate 50 kHz
Rate Outputs 1st and 2nd Binary and 8's Stage
Average Rate 1.55 MHz
Outputs of 1st and 2nd Binary and 2's and 8's Stage 1st Decade
Average Rate 1.65 MHz

FIGURE 4-6
Typical Rate Multiplier Outputs

SECTION 5

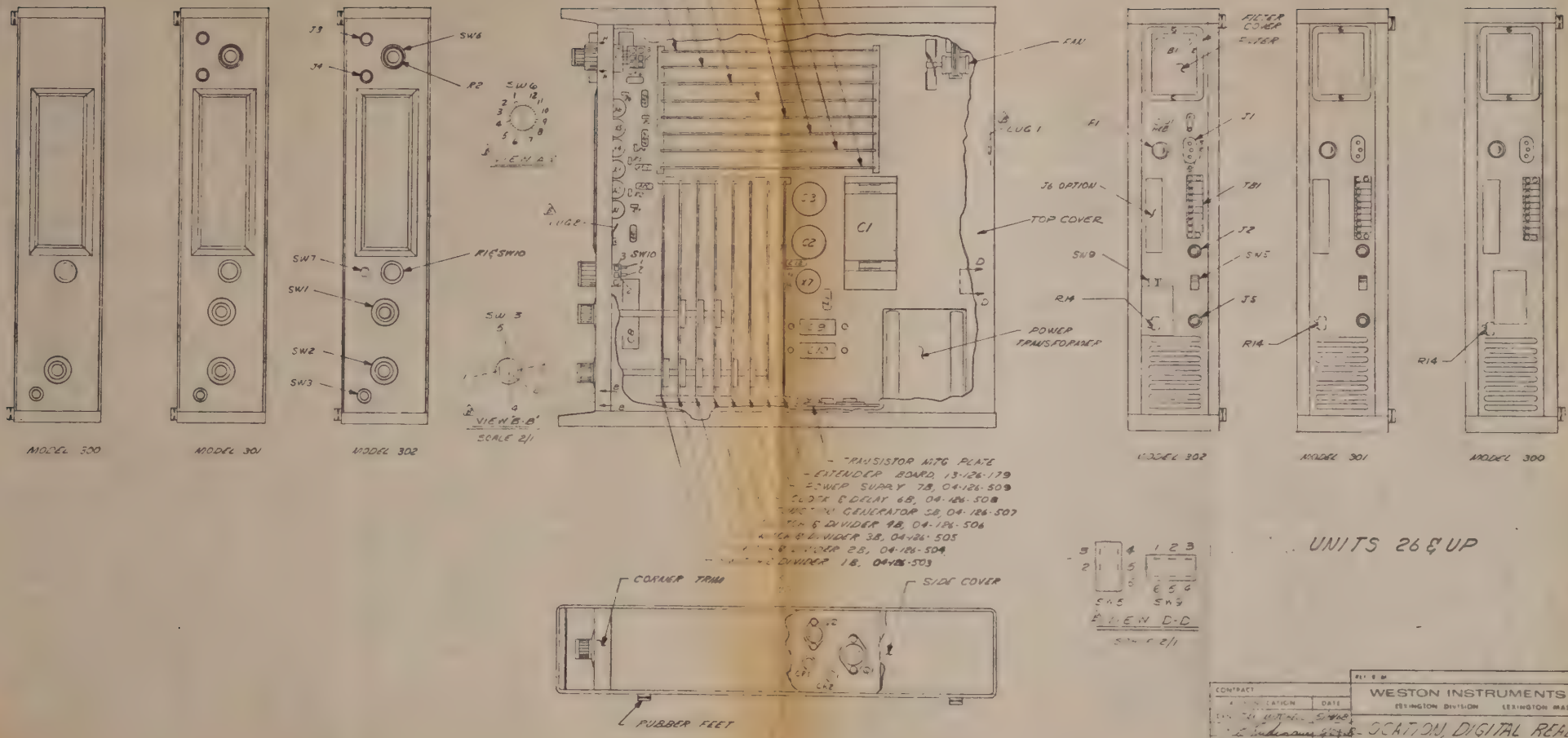
SIGNAL FLOW DIAGRAMS AND SCHEMATICS

This section contains an overall block diagram and detailed circuit and location diagrams necessary for maintenance of the Frequency Counter.

The block diagram, when used in conjunction with the Theory of Operation (Section 4), should aid in understanding circuit interrelationships.

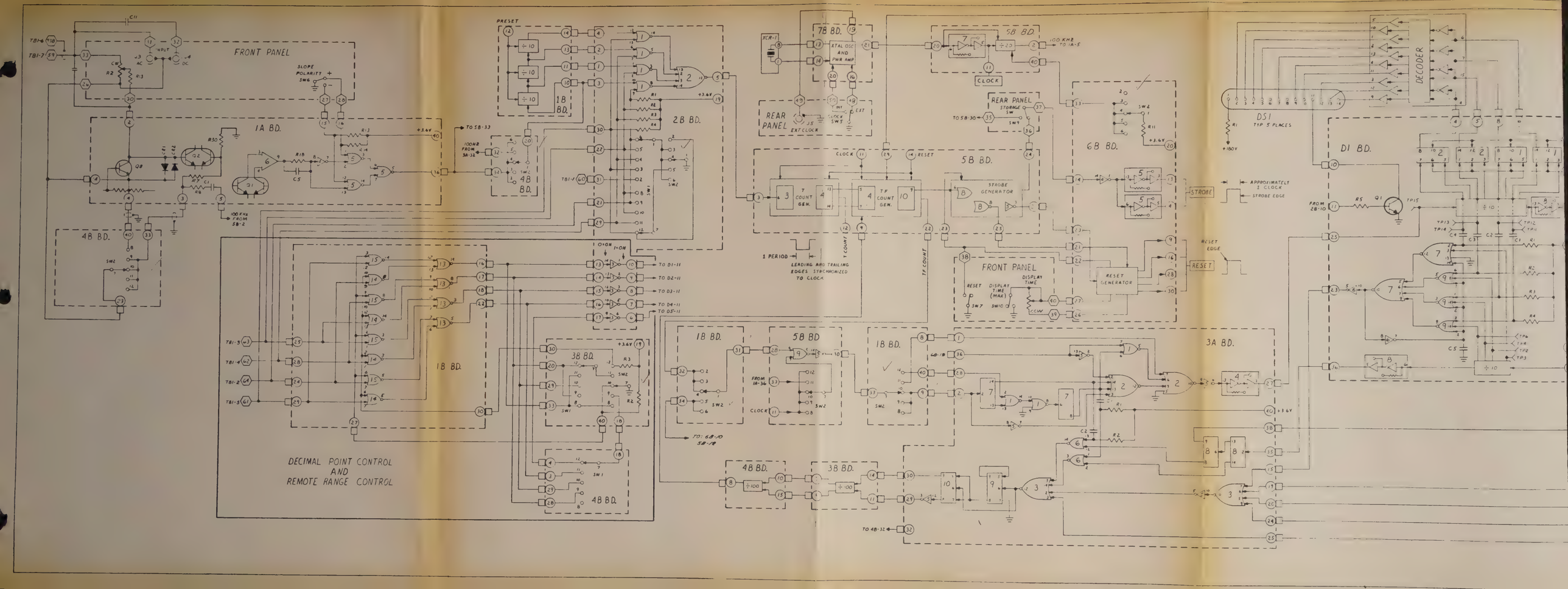
Following is a list of the diagrams included in this section:

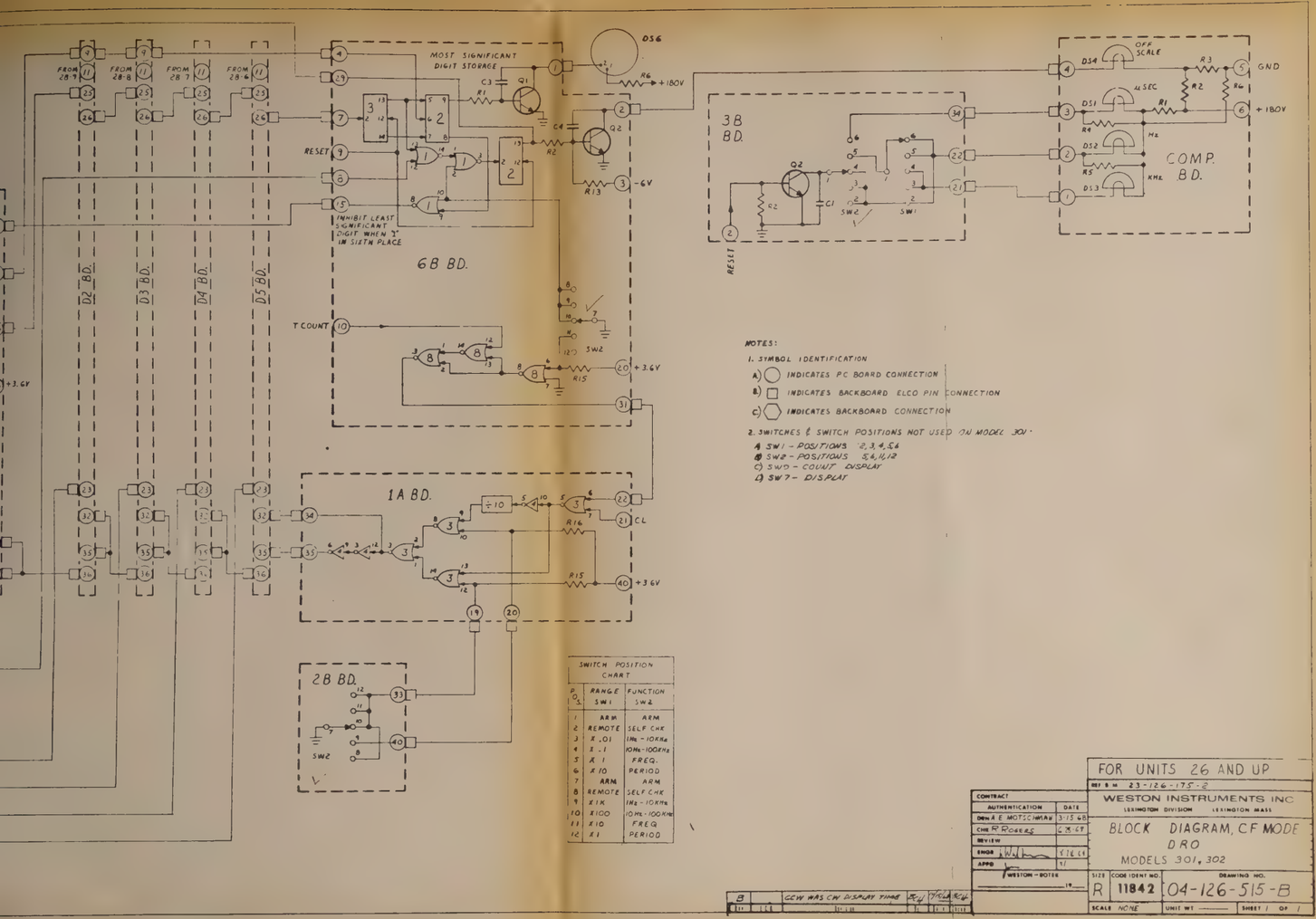
Number				
300	301	301C	302	Title
04-126-514	04-126-539	04-126-540	04-126-515	Block Diagram
04-126-242	04-126-242	11-126-242	04-126-242	Location Diagram
04-126-518	04-126-519	04-126-519	04-126-519	3A, Rate Multiplier Board
04-126-520	04-126-521	04-126-521	04-126-521	1B, Switch & Divider Board
04-126-522	04-126-523	04-126-523	04-126-523	2B, Switch & Divider Board
04-126-524	04-126-525	04-126-525	04-126-525	3B, Switch & Divider Board
04-126-526	04-126-527	04-126-527	04-126-527	4B, Switch & Divider Board
04-126-528	04-126-529	04-126-529	04-126-529	5B, Function Generator Board
04-126-530	04-126-531	04-126-531	04-126-531	6B, Clock & Display Board
04-126-532	04-126-533	04-126-533	04-126-533	7B, Power Supply Board
04-126-536	04-126-536	04-126-536	04-126-536	D1-D5, Decade Boards
04-126-516	04-126-517	04-126-517	04-126-517	1A, Input Amplifier Board
04-126-534	04-126-535	04-126-535	04-126-535	Wiring Diagram



	ADDED 48 ROLLED HOLE ANTI-STATIC SNAP BUSHINGS	
	DELETED R9	

CONTRACT	WESTON INSTRUMENTS INC.	
APPROVALS	NEWTON DIVISION NEWTON MASS	
DRAWN	DIGITAL VOLTMETER SYSTEM	
TRACED		
CHECKED	OPERATION, DIGITAL READOUT	
ENGINEER	MODELS 300, 301, 302	
SUPERVISOR	SIZE / SCHEDULE NO. D 11842	DRAWING NO. W-126-242-C


FRONT PANEL
SLOPE POLARITY SW6
1A BD.
2B BD.
1B BD.
4B BD.
3B BD.
5B BD.
7B BD.
6B BD.
3A BD.
D1 BD.
DECODER
DS1 TYP 5 PLACES
REAR PANEL
XCR-1
RTAL OSC AND PWR AMP
100 KHZ TO 1A-5
CLOCK
STORAGE SW
STROBE GENERATOR
STROBE
APPROXIMATELY 1 CLOCK STROBE EDGE
RESET
RESET EDGE
RESET GENERATOR
DISPLAY TIME
DISPLAY TIME (MAX)
T COUNT GEN.
TF COUNT GEN.
1 PERIOD
LEADING AND TRAILING EDGES SYNCHRONIZED TO CLOCK
T COUNT
TF COUNT
DECIMAL POINT CONTROL AND REMOTE RANGE CONTROL
TO D1-11
TO D2-11
TO D3-11
TO D4-11
TO D5-11
TO 1A-36
TO 6B-10
TO 5B-18
TO 4B-32
TO 5B-33
TO 5B-30
FROM 2B-10
100 KHZ FROM 5B-2
100 KHZ FROM 5B-32
+3.6V
+180V



NOTES:

1. SYMBOL IDENTIFICATION
   - A) ◯ INDICATES PC BOARD CONNECTION
   - B) □ INDICATES BACKBOARD ELCO PIN CONNECTION
   - C) ⬡ INDICATES BACKBOARD CONNECTION
2. SWITCHES & SWITCH POSITIONS NOT USED ON MODEL 301.
   - A SW1 - POSITIONS 2,3,4,5,6
   - B SW2 - POSITIONS 5,6,11,12
   - C SW3 - COUNT DISPLAY
   - D SW7 - DISPLAY

SWITCH POSITION CHART

POS	RANGE SW1	FUNCTION SW2
1	ARM	ARM
2	REMOTE	SELF CHK
3	X .01	1Hz - 10KHz
4	X .1	10Hz - 100KHz
5	X 1	FREQ.
6	X 10	PERIOD
7	ARM	ARM
8	REMOTE	SELF CHK
9	X 1K	1Hz - 10KHz
10	X 100	10Hz - 100KHz
11	X 10	FREQ.
12	X 1	PERIOD

B		CCW WAS CW DISPLAY THRU	5/4

CONTRACT AUTHENTICATION		DATE
DWN	E MOTSCHMAN	3-15-68
CHK	R ROGERS	4-3-68
REVIEW		
ENGR		5-16-68
APPD		

WESTON - BOSTON

FOR UNITS 26 AND UP

REF D W 23-126-1175-2

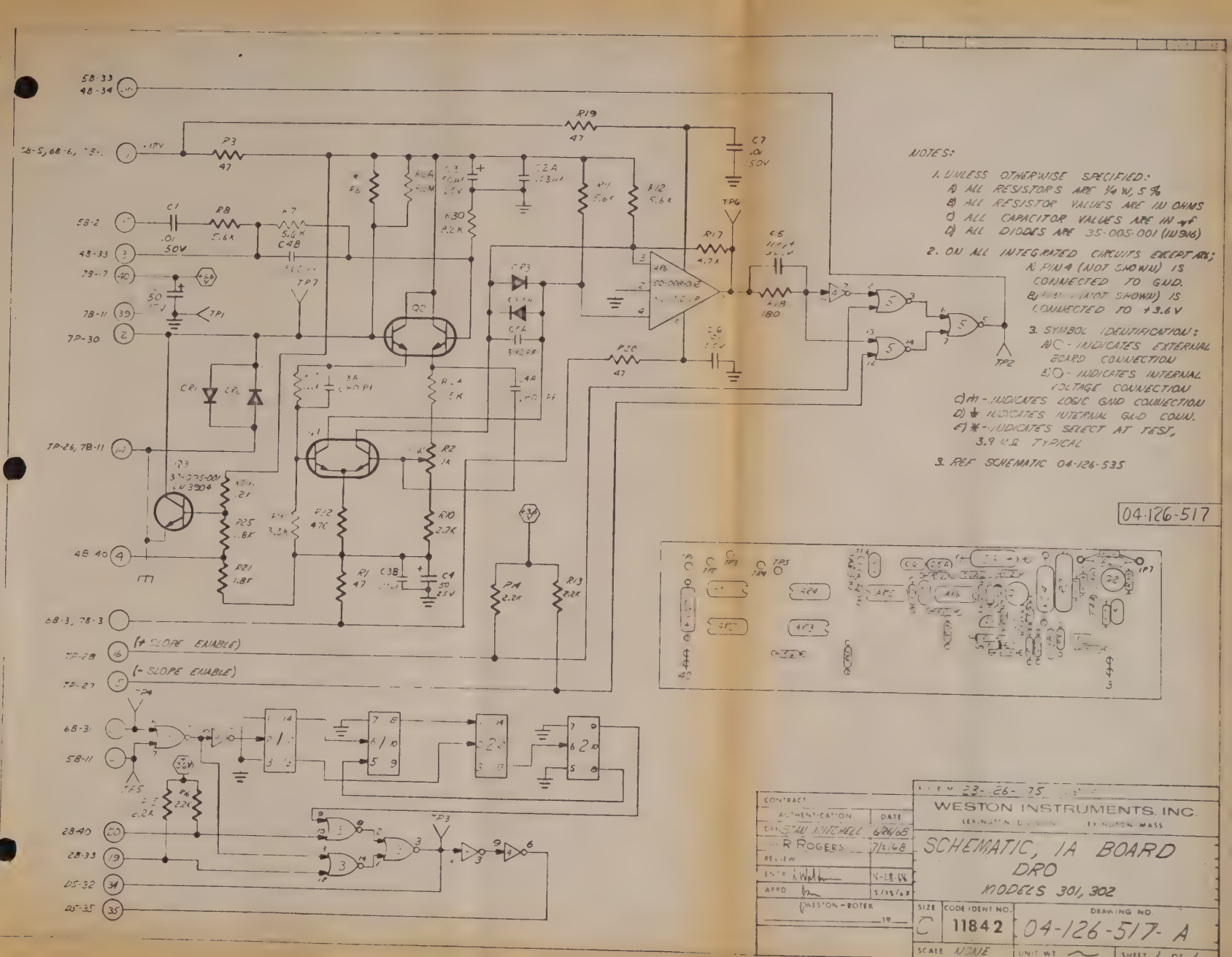
WESTON INSTRUMENTS INC
LEXINGTON DIVISION LEXINGTON MASS

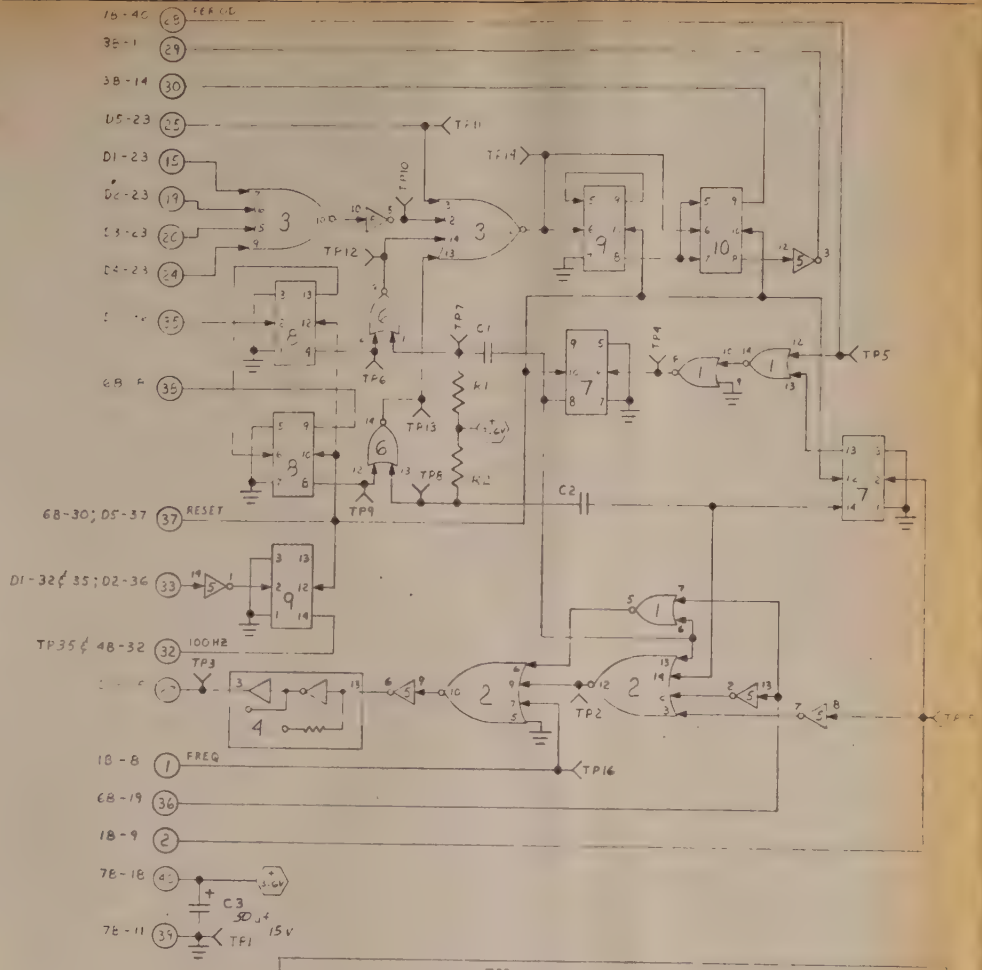
BLOCK DIAGRAM, CF MODE
DRO
MODELS 301, 302

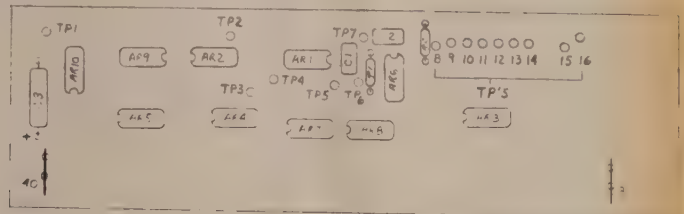
SIZE	CODE IDENT NO.	DRAWING NO.
R	11842	04-126-515-B

SCALE NONE UNIT WT ——— SHEET 1 OF 1

04-126-515


NOTES:
1. UNLESS OTHERWISE SPECIFIED:
A) ALL RESISTORS ARE ¼ W, 5%
B) ALL RESISTOR VALUES ARE IN OHMS
C) ALL CAPACITOR VALUES ARE IN μF
D) ALL DIODES ARE 35-005-001 (IN916)
2. ON ALL INTEGRATED CIRCUITS EXCEPT AR5;
A) PIN 4 (NOT SHOWN) IS CONNECTED TO GND.
B) PIN [illegible] (NOT SHOWN) IS CONNECTED TO +3.6V
3. SYMBOL IDENTIFICATION:
A) ○ - INDICATES EXTERNAL BOARD CONNECTION
B) ○ - INDICATES INTERNAL VOLTAGE CONNECTION
C) ⏚ - INDICATES LOGIC GND CONNECTION
D) ⏚ INDICATES INTERNAL GND CONN.
E) * - INDICATES SELECT AT TEST, 3.9 KΩ TYPICAL
3. REF SCHEMATIC 04-126-535
04-126-517
(+ SLOPE ENABLE)
(- SLOPE ENABLE)
ITEM 23-26-75
WESTON INSTRUMENTS, INC.
LEXINGTON DIVISION LEXINGTON MASS
SCHEMATIC, IA BOARD
DRO
MODELS 301, 302
CONTRACT
AUTHENTICATION DATE
ENG. STAN MITCHELL 6/26/68
R ROGERS 7/2/68
REVIEW
ENGR K Walsh 8-28-68
APPD 9/25/68
WESTON-BOTER 19
SIZE C
CODE IDENT NO. 11842
DRAWING NO. 04-126-517-A
SCALE NONE
UNIT WT
SHEET 1 OF 1





NOTES:

1. UNLESS SPECIFIED OTHERWISE:
   A.) ALL RESISTORS ARE 2.2KΩ, 1/4 W, 5%
   B.) ALL CAPACITORS ARE 270pf, 300V
2. ON ALL INTEGRATED CIRCUITS:
   A.) PIN 4 (NOT SHOWN) IS CONNECTED TO GND
   B.) PIN 11 (NOT SHOWN) IS CONNECTED TO +3.6V
3. SYMBOL IDENTIFICATION
   A.) ○ INDICATES EXTERNAL BOARD CONNECTION
   B.) ▽ INDICATES EXTERNAL VOLTAGE CONNECTION
   C.) ▽ INDICATES INTERNAL GND CONNECTION
4. REF. DRAWING: 04-126-535

04-126-519

CONTRACT AUTHENTICATION	DATE
DRAWN	[illegible]
TRACED	
CHECKED	
APPROVED	
MFG	

WESTON-BOYER

19

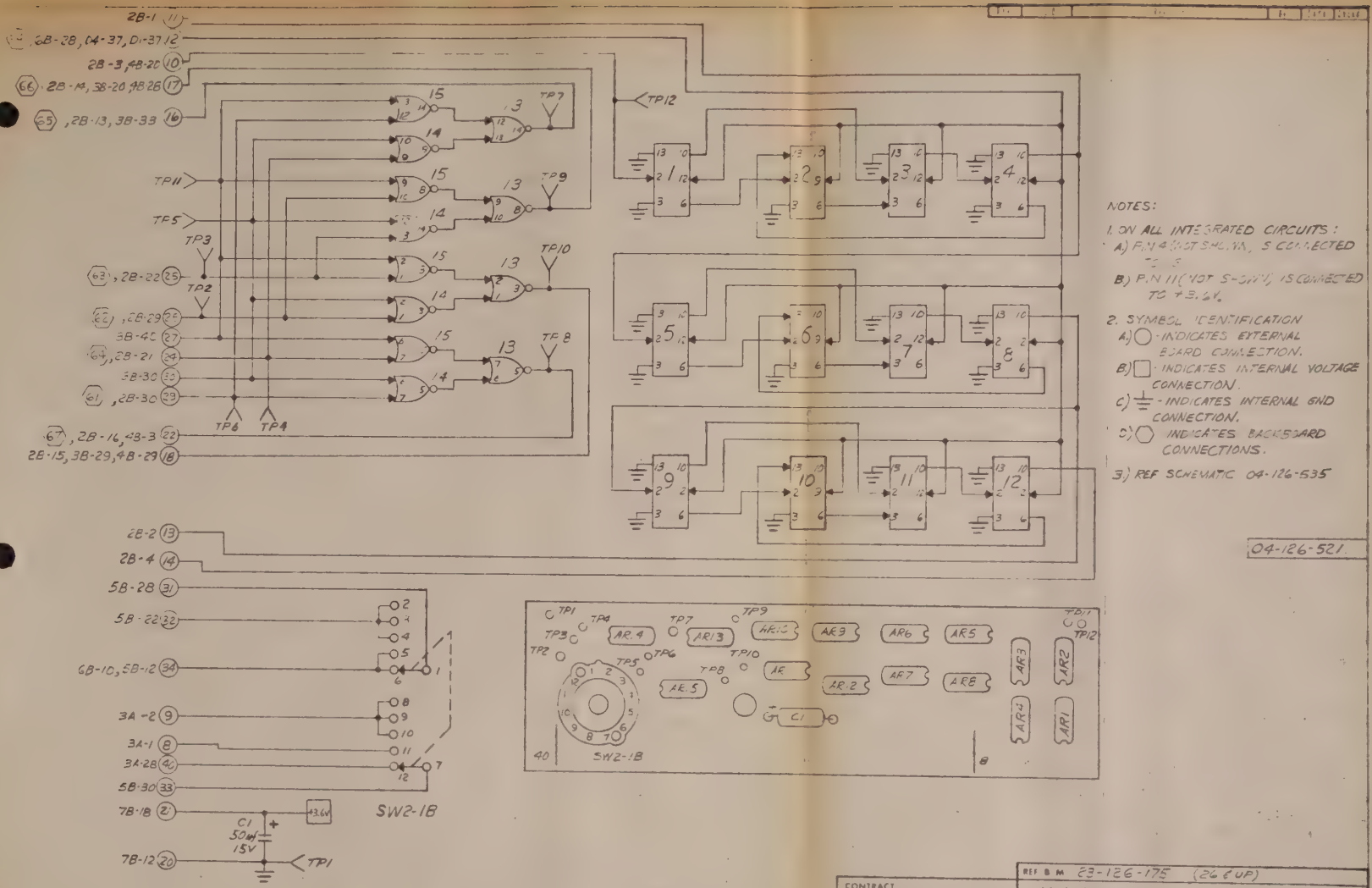
REF B M 23-126-5

WESTON INSTRUMENTS INC.
LEXINGTON DIVISION LEXINGTON MASS

SCHEMATIC, 3A BOARD
DRO
MODEL 301 302

SIZE	CODE IDENT NO	DRAWING NO.
C	11842	04-126-519-A

SCALE NONE | UNIT WT | SHEET 1 OF

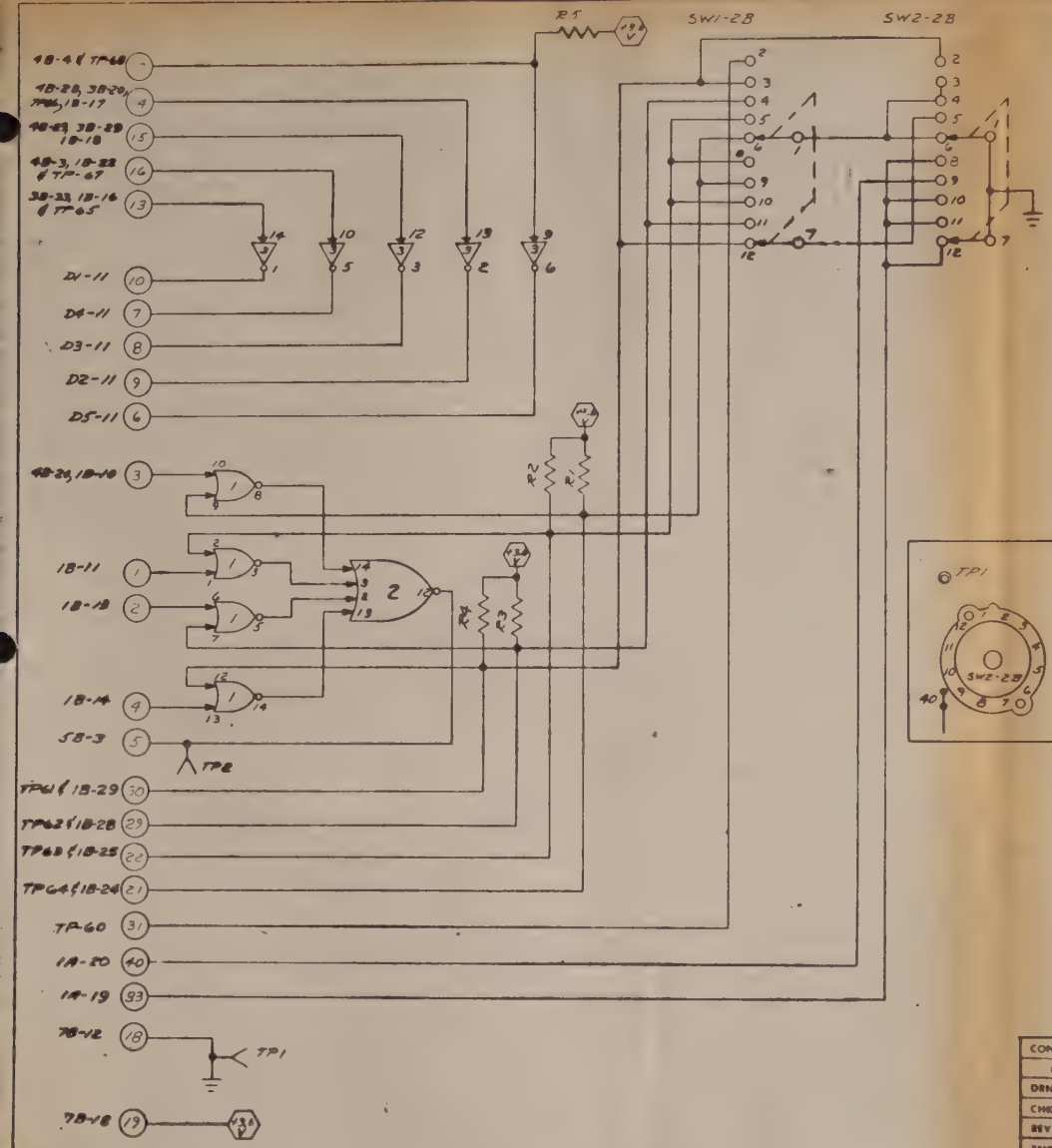


NOTES:

1. ON ALL INTEGRATED CIRCUITS:
   A) P.N 4 (NOT SHOWN) IS CONNECTED TO GND
   B) P.N 11 (NOT SHOWN) IS CONNECTED TO +3.6V
2. SYMBOL IDENTIFICATION
   A) ○ - INDICATES EXTERNAL BOARD CONNECTION.
   B) □ - INDICATES INTERNAL VOLTAGE CONNECTION.
   C) ⏚ - INDICATES INTERNAL GND CONNECTION.
   D) ⬡ INDICATES BACKBOARD CONNECTIONS.
3) REF SCHEMATIC 04-126-535

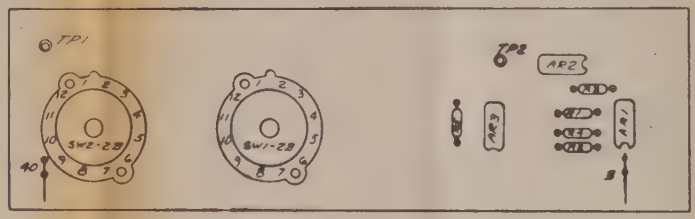
04-126-521

CONTRACT		REF B M 23-126-175 (26 & UP)
AUTHENTICATION	DATE	WESTON INSTRUMENTS, INC.
DRN E. V. Barrow 6K	3/20/68	LEXINGTON DIVISION LEXINGTON MASS.
CHK		SCH., DIVIDER BD. 1B
REVIEW		DRO
ENGR		MODEL 301 & 302
APPD		
WESTON – BOTEK 19		SIZE C · CODE IDENT NO. 11842 · DRAWING NO. 04-126-521-A
		SCALE NONE · UNIT WT — · SHEET , OF

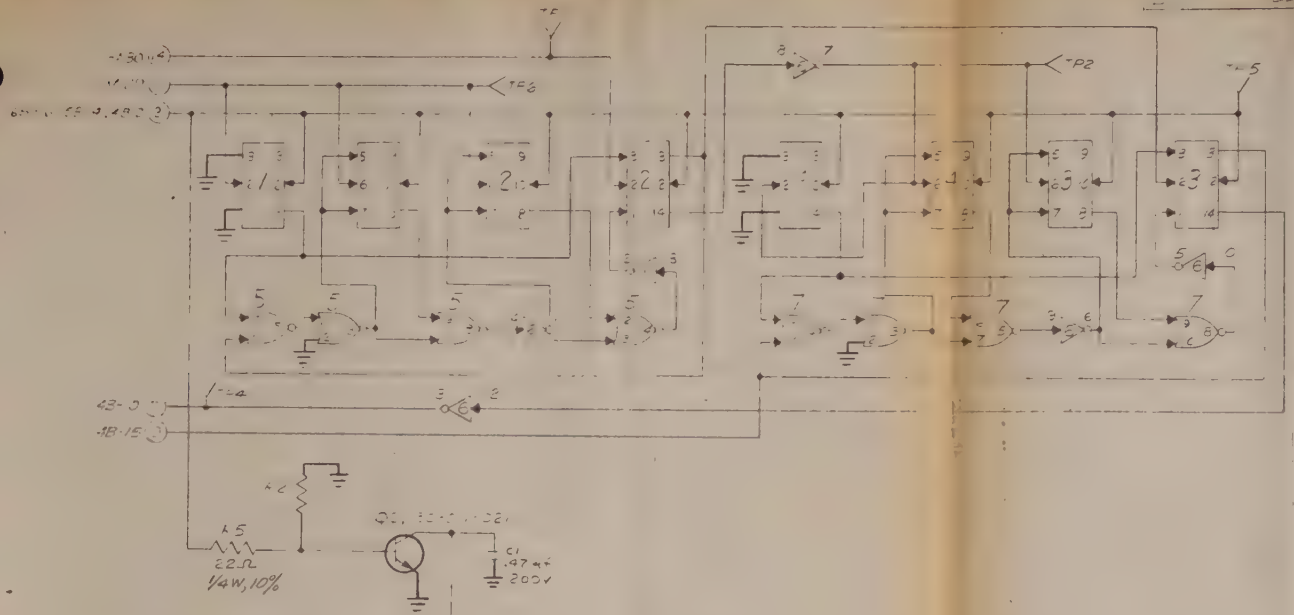


NOTES:

1) UNLESS OTHERWISE SPECIFIED:
   A) ALL RESISTORS ARE 2.2K, 1/4 W, 5%
2) ON ALL INTEGRATED CIRCUITS
   A) PIN 8 (NOT SHOWN) CONNECTED TO GND.
   B) PIN 11 (NOT SHOWN) CONNECTED TO +3.6V
3) SYMBOL IDENTIFICATION
   A) ○ INDICATES EXTERNAL BOARD CONN
   B) ○ INDICATES INTERNAL VOLTAGE CONN
   C) ⏚ INDICATES INTERNAL GND CONN.
4) REF SCHEMATIC 04-126-535



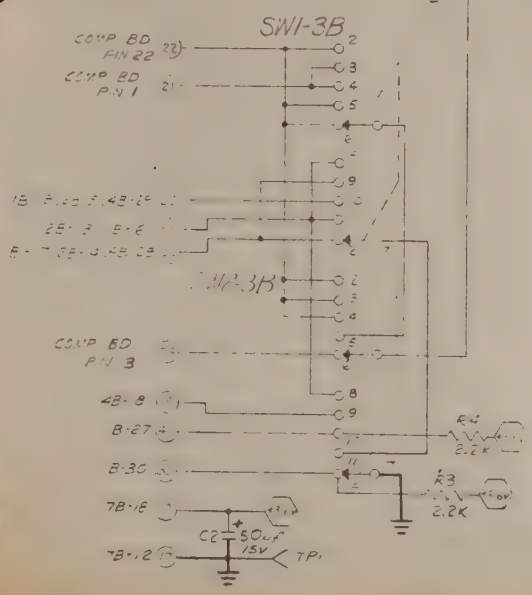
CONTRACT		REF B M 53-2-175 26 SUP
AUTHENTICATION	DATE	WESTON INSTRUMENTS, INC.
DRN C. PETE	3/3/68	LEXINGTON DIVISION LEXINGTON MASS.
CHK R. ROGERS	3-7-68	SCHEMATIC, 2B BOARD DRO MODELS 301, 302
REVIEW		
ENGR	4-24-68	
APPD	5/14/68	
WESTON-ROTEK 19		SIZE C · CODE IDENT NO. 11842 · DRAWING NO. 04-126-523-A
		SCALE NONE · UNIT WT · SHEET 1 OF 1

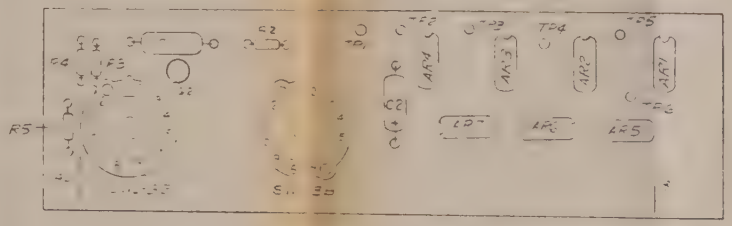


NOTES

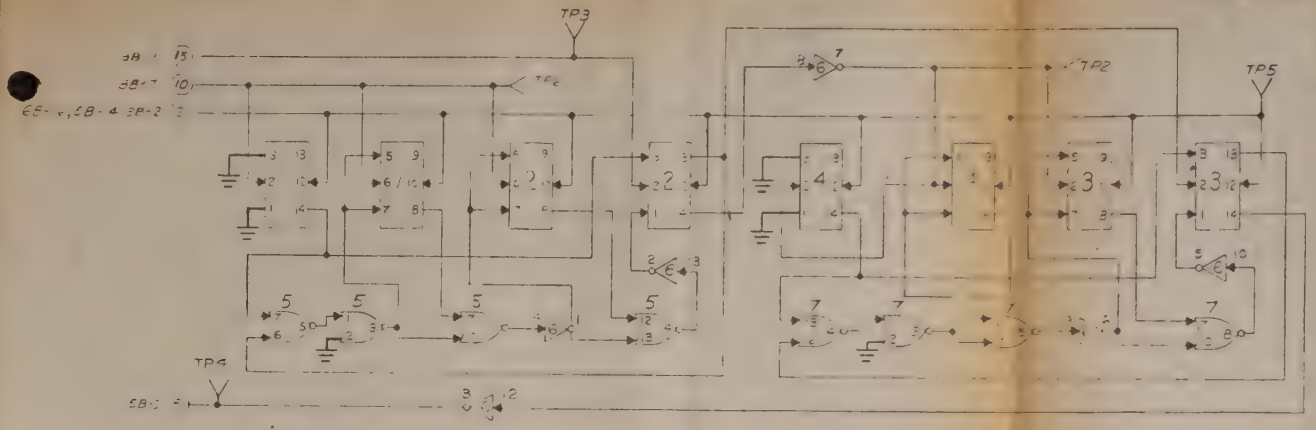
1. UNLESS OTHERWISE SPECIFIED:
   A) ALL RESISTOR VALUES ARE IN OHMS.
   B) ALL RESISTORS ARE 1/4W, 5%.
2. ON ALL INTEGRATED CIRCUITS
   A) PIN 4 (NOT SHOWN) IS CONNECTED TO GND.
   B) PIN 8 (NOT SHOWN) IS CONNECTED TO +5.0V.

4. SYMBOL IDENTIFICATION
   A) ⊃ - INDICATES EXTERNAL BOARD CONNECTION.
   B) ⊃ - INDICATES INTERNAL WIRING CONNECTION.
   C) ⏚ - INDICATES INTERNAL GND CONNECTION.



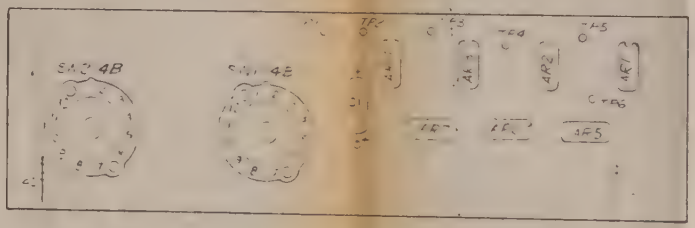


CONTRACT		WESTON INSTRUMENTS INC.	
AUTHENTICATION	DATE	LEXINGTON DIVISION LEXINGTON MASS	
DRN		SCHEMATIC, PC BOARD	
CHK		DRO	
REVIEW		MODEL 301, 302	
ENGR			
APPD			
WESTON-ROTEK 19__		SIZE C	CODE IDENT NO. 11842
		DRAWING NO. 04-126-525 B	
		SCALE NONE	UNIT WT — SHEET 1 OF 1

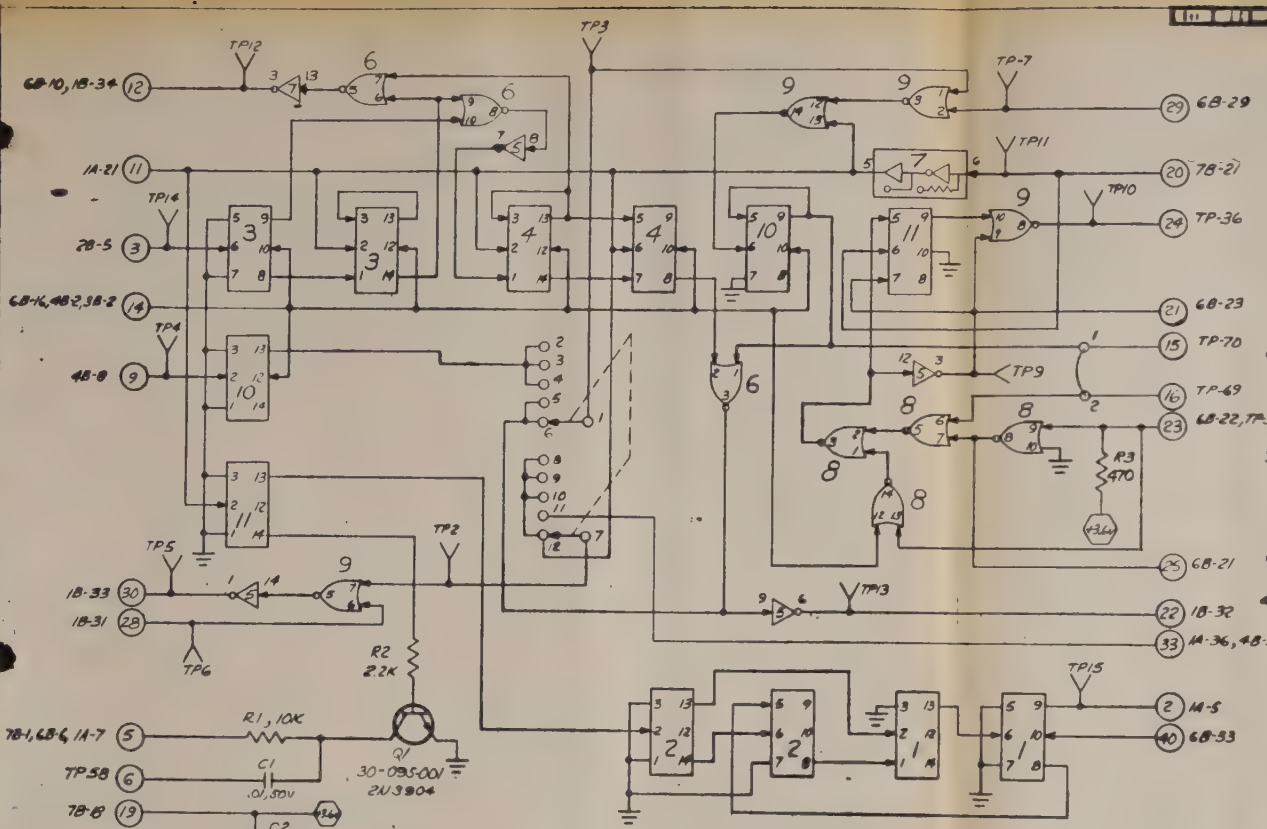


NOTES:

1. ON ALL INTEGRATED CIRCUITS:
   A) PIN 4 (NOT SHOWN) IS CONNECTED TO GND.
   B) PIN 11 (NOT SHOWN) IS CONNECTED TO +3.6V.



CONTRACT AUTHENTICATION	DATE	WESTON INSTRUMENTS INC. LEXINGTON DIVISION LEXINGTON MASS
DRN		SCHEMATIC, 4E BOARD DRO MODEL 301, 302
CHD		
REVIEW		
ENGR		
APPD		
WESTON-BOYER 19		SIZE C · CODE IDENT NO. 11842 · DRAWING NO. 04-126-527-A · SCALE NONE · UNIT WT — · SHEET 1 OF 1



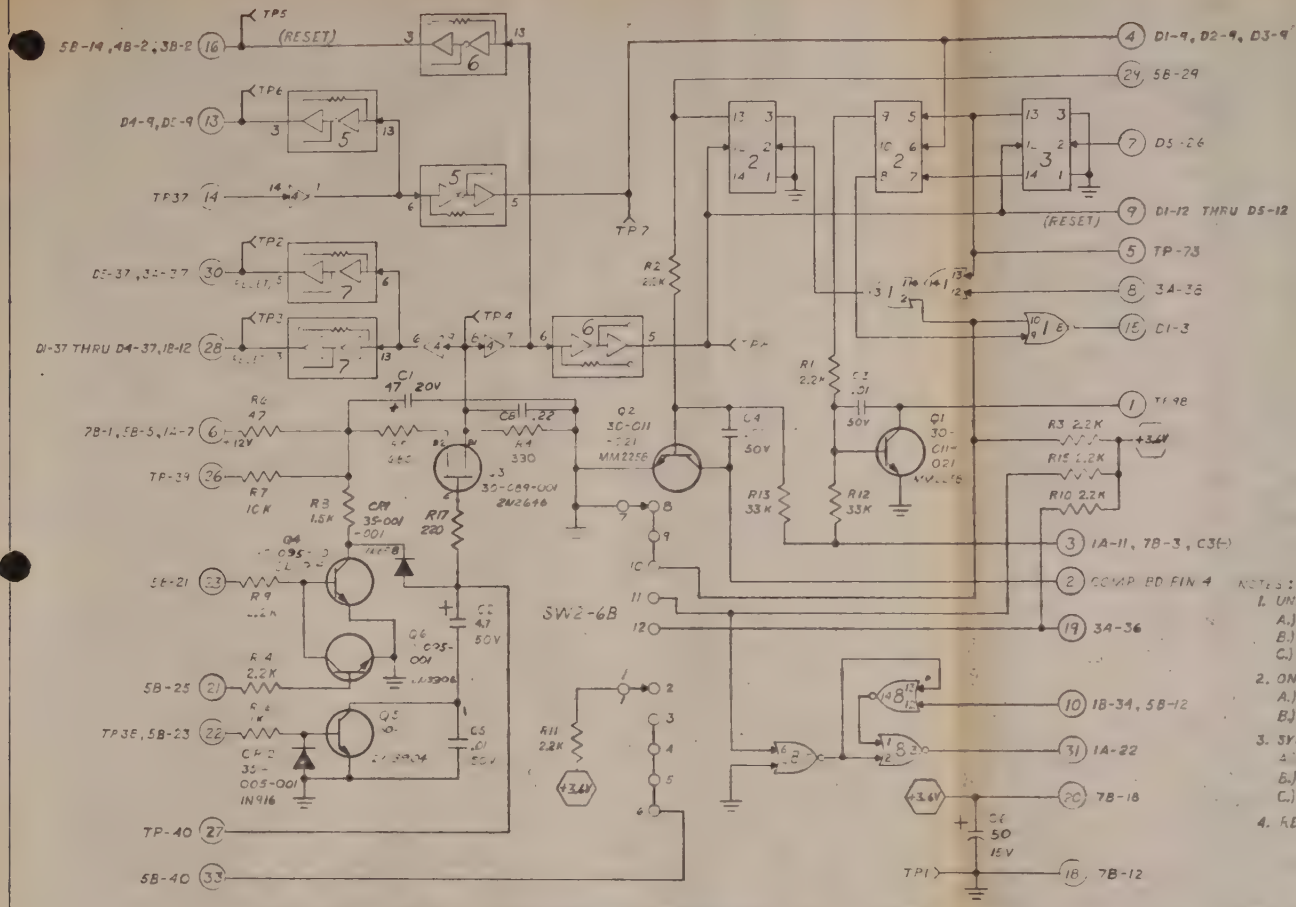
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   A) ALL RESISTOR VALUES ARE IN OHMS.
   B) ALL RESISTORS ARE 1/4W, 5%.
   C) ALL CAPACITOR VALUES ARE IN uf.
2. ON ALL INTEGRATED CIRCUITS
   A) PIN 4 (NOT SHOWN) IS CONNECTED TO GND.
   B) PIN 11 (NOT SHOWN) IS CONNECTED TO +3.6V.
3. SYMBOL IDENTIFICATION
   A) ○ - INDICATES EXTERNAL BOARD CONNECTION.
   B) ⬡ - INDICATES INTERNAL VOLTAGE CONNECTION.
   C) ⏚ - INDICATES INTERNAL GND CONNECTION
4. REF SCHEMATIC 04-126-535

04-126-529

CONTRACT		REF B-M 23-126-175 2&UP
AUTHENTICATION	DATE	WESTON INSTRUMENTS, INC. LEXINGTON DIVISION LEXINGTON MASS.
DRN C Baranowski	3/28/68	SCHEMATIC, 5B BOARD DRO MODEL 301, 302
CHK R Rogers	3/7/68	
REVIEW		
ENGR T Weber	4/24/68	
APPD	5/14/68	
WESTON — ROTEK 19		SIZE C CODE IDENT NO. 11842 DRAWING NO. 04-126-529-A
		SCALE None WGHT WT ~ SHEET 1 OF 1

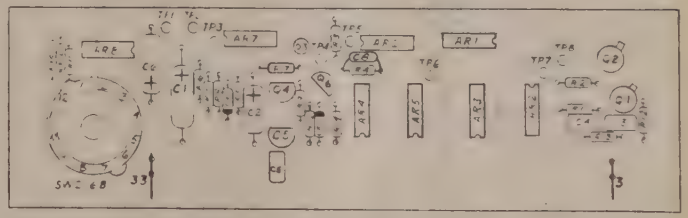
150



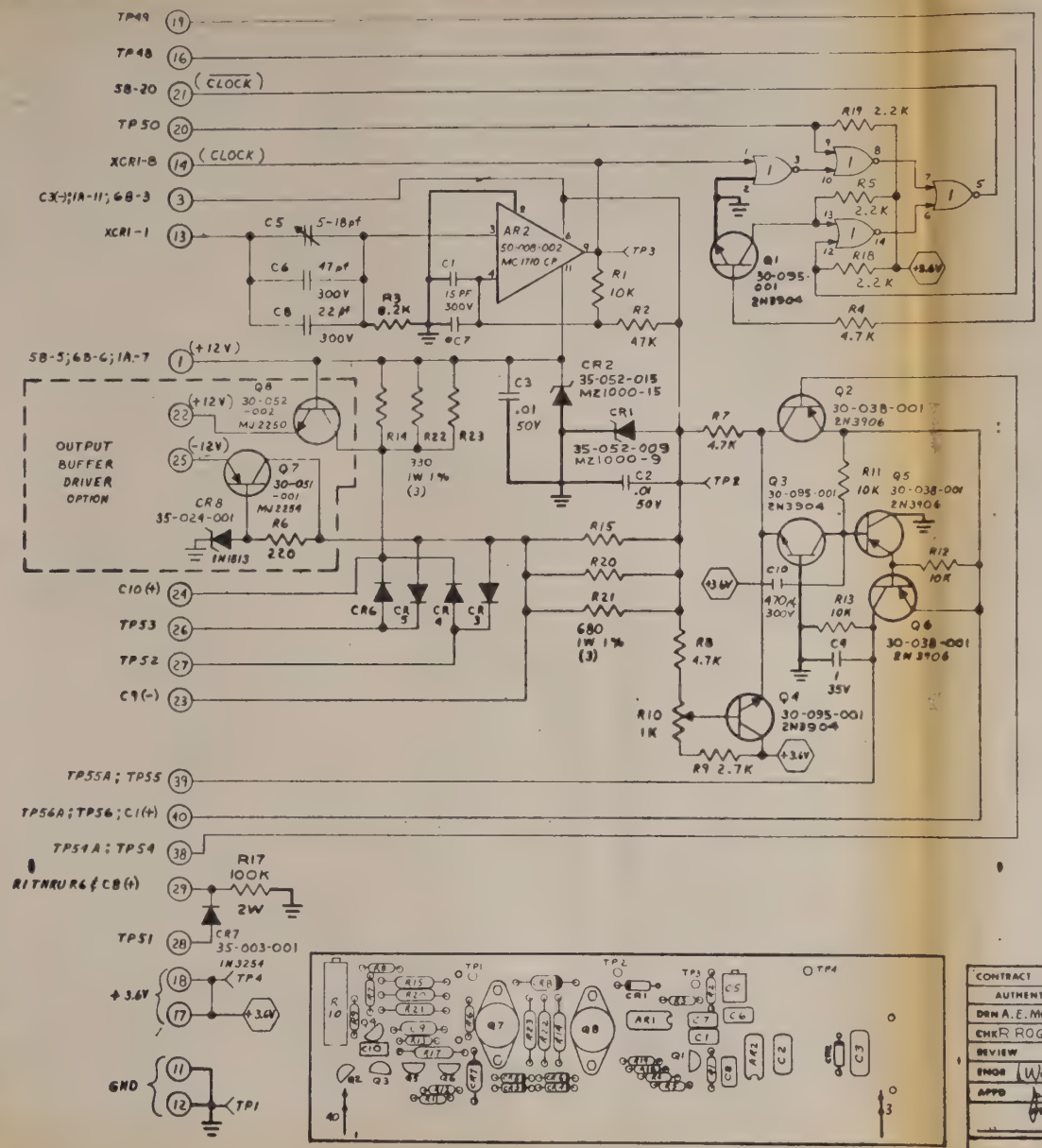
04-126-531

NOTES:

1. UNLESS OTHERWISE SPECIFIED
   A.) ALL RESISTORS ARE 1/4W, 5%
   B.) ALL RESISTOR VALUES ARE IN OHMS
   C.) ALL CAPACITOR VALUES ARE IN μF
2. ON ALL INTEGRATED CIRCUITS
   A.) PIN 4 (NOT SHOWN) IS CONNECTED TO GND
   B.) PIN 11 (NOT SHOWN) IS CONNECTED TO +3.6V
3. SYMBOL IDENTIFICATION
   A.) [illegible] INDICATES EXTERNAL [illegible] CONNECTION
   B.) ○ INDICATES INTERNAL +12 VOLT CONNECTION
   C.) ⏚ INDICATES INTERNAL GND CONNECTION
4. REF SCHEMATIC 04-126-535



CONTRACT		REF B M [illegible] 75 [illegible]
AUTHENTICATION	DATE	WESTON INSTRUMENTS, INC.
DRN [illegible]	[illegible]	LEXINGTON DIVISION LEXINGTON MASS.
CHK [illegible]	27-68	SCHEMATIC, 6B BOARD
REVIEW		DRO
ENGR [illegible]	[illegible]	MODEL 301,302
APPD [illegible]	5/31/68	
WESTON—BOTER 19		SIZE C · CODE IDENT NO. 11842 · DRAWING NO. 04-126-531-A
		SCALE NONE · UNIT WT · SHEET 1 OF 1



NOTES:

1. UNLESS OTHERWISE SPECIFIED
   - A.) ALL RESISTORS ARE 1/4 W, 5%
   - B.) RESISTOR VALUES ARE IN OHMS
   - C.) CAPACITOR VALUES ARE IN μF
   - D.) ALL DIODES ARE 35-055-001 (IN4002)
2. ON AR1; PIN 4 IS CONNECTED TO GND PIN 11 IS CONNECTED TO +3.6 V
3. SYMBOL IDENTIFICATION
   - A.) * INDICATES TRIM COMPONENT
   - B.) ○ INDICATES EXTERNAL BOARD CONNECTION
   - C.) ○ INDICATES INTERNAL VOLTAGE CONNECTION
   - D.) ⏚ INDICATES INTERNAL GND CONNECTION
4. REF SCHEMATIC 04-126-535

04-126-533

CONTRACT	
AUTHENTICATION	DATE
DRN A.E. MOTSCHMAN	3-20-68
CHK R ROGERS	6-17-68
REVIEW	
ENGR	8-26-68
APPD	8/4/68
WESTON – BOYER	

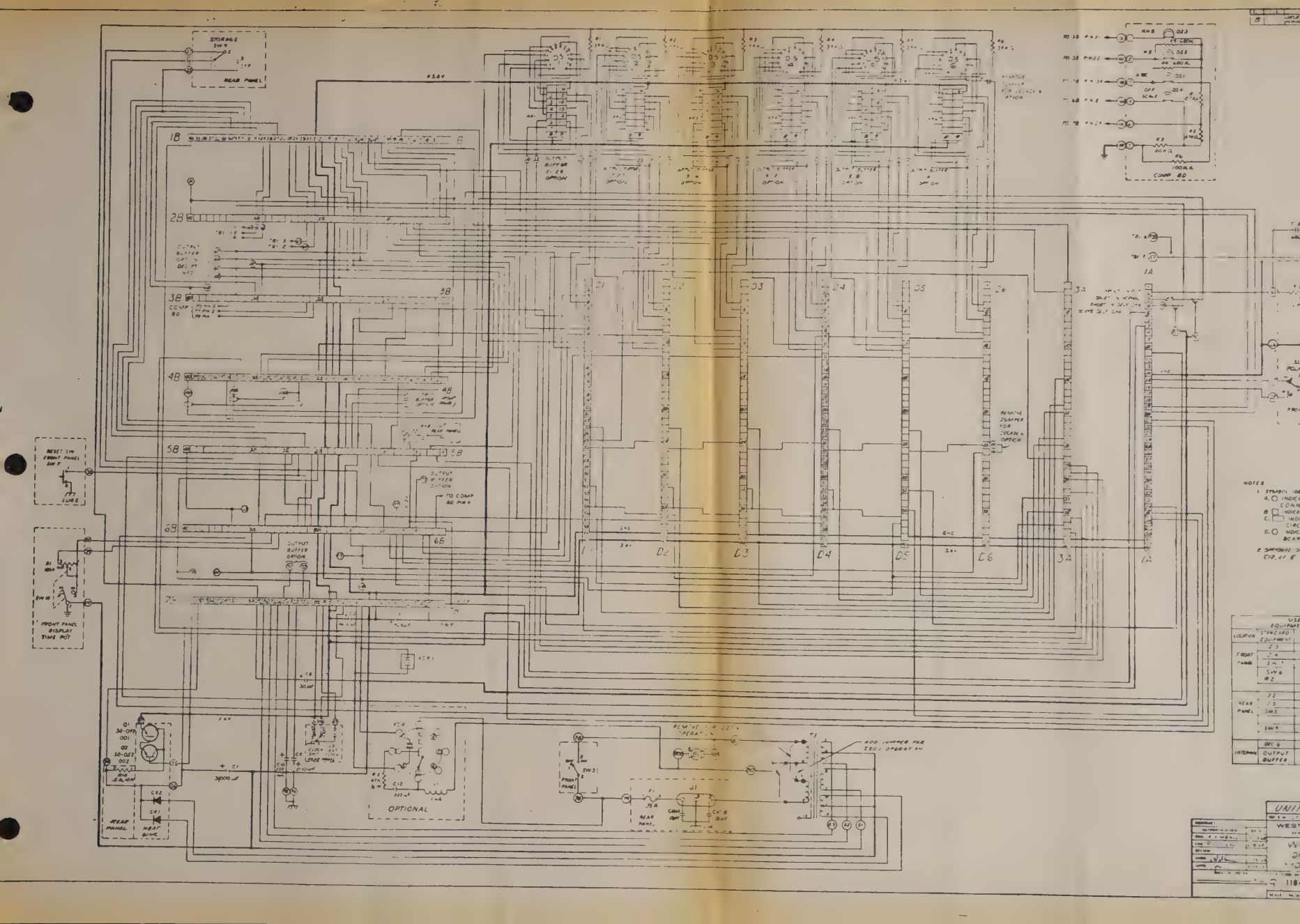
REF S/M 23-126-115 26 & UP

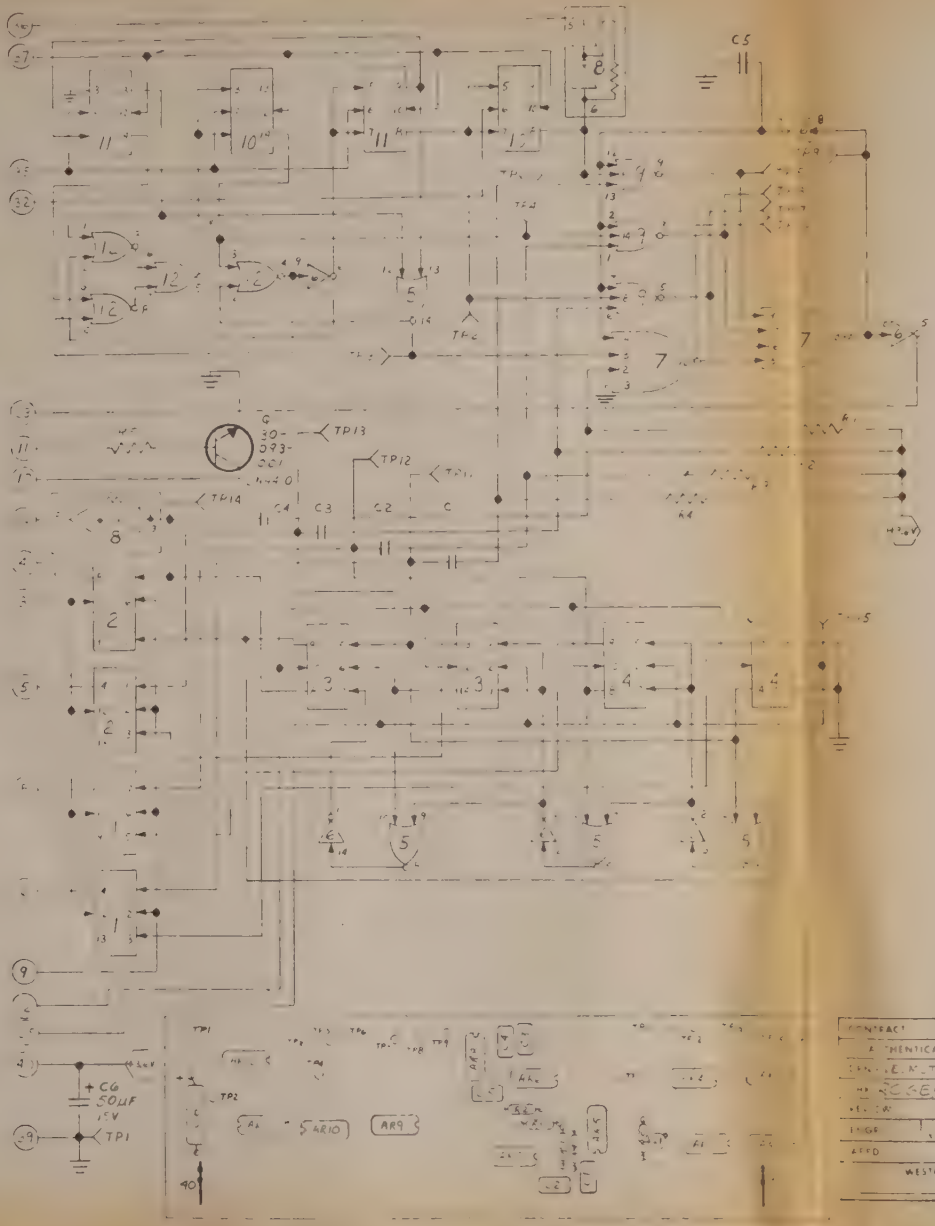
WESTON INSTRUMENTS, INC.
LEXINGTON DIVISION LEXINGTON MASS

SCHEMATIC, 7B BOARD
DRO
MODEL 301, 302

SIZE	CODE IDENT NO.	DRAWING NO.
C	11842	04-126-533-A

SCALE NONE | UNIT WT ——— | SHEET 1 OF 1


STORAGE SW 9
REAR PANEL
P5.6V
1B
2B
3B
4B
5B
6B
7B
COMP BD
OUTPUT BUFFER OPTION
TO COMP BD PIN 4
RESET SW FRONT PANEL SW 1
FRONT PANEL DISPLAY TIME POT
Q1 2N-OPT 001
Q2 2N-OPT 002
REAR PANEL
HEAT SINK
OPTIONAL
FRONT PANEL
REAR PANEL
REMOVE JUMPER FOR ERASE OPTION
ADD JUMPER FOR ERASE OPERATION
COMP BD
1A
2A
3A
D1
D2
D3
D4
D5
D6
NOTES



NOTES :

1. UNLESS OTHERWISE SPECIFIED
   A.) ALL RESISTORS ARE 1.2KΩ, 1/4W, 5%
   B.) ALL CAPACITORS ARE 470PF, 300V
2. ON ALL INTEGRATED CIRCUITS
   A.) PIN 4 (NOT SHOWN) IS CONNECTED TO GND
   B.) PIN 11 (NOT SHOWN) IS CONNECTED TO +3.6V
   C. [illegible]
   D. [illegible]
   E. [illegible]
   F. [illegible] 534 FOR MODEL 300 [illegible]
3. REF SCHEMATIC 04-136-535 FOR MODELS 30[illegible] & 302 EXTERNAL CONNECTION DESIGNATIONS

UNITS 26 & P

CONTRACT		
AUTHENTICATION		DATE
DRAWN	E. M. TSCHMAN	3-16-66
TRACED	ROGERS	3-23-66
CHECKED		
ENGR		
APPD		
WESTON-BOTER		

WESTON INSTRUMENTS INC
LEXINGTON DIVISION LEXINGTON MASS

SCHEMATIC DI-D5 BOARD
DRO
MODEL 300, 301, 302

SIZE	CODE IDENT NO.	DRAWING NO.
C	11842	04-126-536-A

SCALE NONE | UNIT WT | SHEET 01

SECTION 6

REPLACEABLE PARTS

This section contains ordering information for replacement parts listed by assembly. If the value of a component is determined at final test (designated by *), only the manufacturer is given. Where manufacturer and type are not given (designated by **), parts may be ordered directly from Weston-Lexington. These parts should be identified by Weston-Lexington part number; the instrument model number and serial number should also be specified.

Following is a list of assemblies included in this section:

Name	300		301		301C	302	
	04-126-	Page	04-126-	Page	04-126- Page	04-126-	Page
Input Amplifier 1A	516	6-2	517	6-2A	517	517	6-2A
Gate Multiplier 3A	518	6-3	519	6-3A	518	519	6-3A
Switch & Divider 1B	520	6-4	521	6-4A	541	521	6-4A
Switch & Divider 2B	522	6-4	523	6-4A	542	523	6-4A
Switch & Divider 3B	524	6-5	525	6-5A	524	525	6-5A
Switch & Divider 4B	526	6-5	527	6-5A	543	527	6-5A
Function Generator 5B	528	6-6	529	6-6A	528	529	6-6A
Clock & Display 6B	530	6-7	531	6-7A	544	531	6-7A
Power Supply 7B	532	6-8	533	6-8A	533	533	6-8A
Decade D1-D6	536	6-9	536	6-9	536	536	6-9
Scale Counter Bd. 1	-	-	-	-	545	-	-
Backboard and Component Bd.	534	6-10	534	6-10	540	535	6-10A
Frame Assembly	514	6-11	539	6-11B	546	515	6-11D
Accessory List	-	6-12	-	6-12	-	-	6-12
Options							

INPUT AMPLIFIER BOARD 1A 04-125-516

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR. TYPE
CR1,CR2	Diode, 10MA 100V, Silicon Switching	35-005-001	Texas Inst.	1N916
R18	Resistor, 180Ω, Fixed Comp, 1/4W, 5%	40-003-004	Allen-Bradley	CB
R19,20	Resistor, 47Ω, Fixed Comp, 1/4W, 5%	40-003-016	Allen-Bradley	CB
R7,R8	Resistor, 5.6K, Fixed Comp, 1/4W, 5%	40-003-026	Allen-Bradley	CB
R4	Resistor, 39K, Power, 2W, 5%	40-218-003	Allen-Bradley	HB
R17	Resistor, 120K, Fixed Comp, 1/4W, 5%	40-003-049	Allen-Bradley	CB
C5	Capacitor, Mica, 100pf, 300V, 3%	45-003-007	El Menco	DM15F
C2A	Capacitor, Mica, 47pf, 300V, 3%	45-002-005	El Menco	DM15F
C1,C6,C7	Capacitor, Ceramic, .01μf, 50V,	45-902-001	Cramer	CK-103
C2	Capacitor, Elect. Alum, 50μf, 15V	45-215-053	Sprague	30D
AR6	Differential Comparator	50-008-002	Motorola	MC1710CP
AR3	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR4	Hex Inverter	50-009-003	Motorola	MC789P

INPUT AMPLIFIER BOARD 1A 04-126-517

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR. TYPE
Q3	Transistor, NPN, Silicon	30-095-001	Motorola	2N3904
CR1,2,3,4	Diode, 1a, 100V, Silicon Switching	35-005-001	Texas Inst.	1N916
R6A	Resistor, Selected Trim, 1W	*	IRC	CEC
R18	Resistor, 180Ω, Fixed Comp, 1/4W, 5%	40-003-004	Allen-Bradley	CB
R22	Resistor, 470Ω, Fixed Comp, 1/4W, 5%	40-003-006	Allen-Bradley	CB
R30	Resistor, 8.2K, Fixed Comp, 1/4W, 5%	40-003-011	Allen-Bradley	CB
R1,3,19,20	Resistor, 47Ω, Fixed Comp, 1/4W, 5%	40-003-016	Allen-Bradley	CB
R17	Resistor, 4.7K, Fixed Comp, 1/4W, 5%	40-003-018	Allen-Bradley	CB
R13,14,15,16,23	Resistor, 2.2K, Fixed Comp, 1/4W, 5%	40-003-020	Allen-Bradley	CB
R8,11,12,7	Resistor, 5.6K, Fixed Comp, 1/4W, 5%	40-003-026	Allen-Bradley	CB
R24	Resistor, 1.5K, Fixed Comp, 1/4W, 5%	40-003-032	Allen-Bradley	CB
R9	Resistor, 3.3K, Fixed Comp, 1/4W, 5%	40-003-041	Allen-Bradley	CB
R10	Resistor, 2.7K, Fixed Comp, 1/4W, 5%	40-003-042	Allen-Bradley	CB
R2	Resistor, Variable 1K, WW Commercial, ±10%, 15 Turn	40-426-001	Bourns	3067P
R25,R21	Resistor, 1.8K, Fixed Comp, 1/4W, 5%	40-003-048	Allen-Bradley	CB
R26	Resistor, 12K, Fixed Comp, 1/4W, 5%	40-003-015	Allen-Bradley	CB
R6	Resistor, 8.2M, Fixed Comp, 1/4W, 5%	40-003-050	Allen-Bradley	CB
C3A,C4A	Capacitor, 680pf, Mica, 300V, 3%	45-003-027	El Menco	DM15F
C1,6,7	Capacitor, .01μf, 50V, Ceramic	45-902-001	Cramer	CK-103

INPUT AMPLIFIER BOARD 1A CONTINUED 04-126-517

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANFUACTURER	MFR.TYPE
C2A,3B	Capacitor, .03μf, 50V,	45-902-002	Cramer	CK-303
C2	Capacitor, 50μf, 15V, Elect. Alum.	45-215-053	Sprague	30D
C3,4	Capacitor, 50μf, 15V, Elect. Alum.	45-215-004	Sprague	30D
C5A	Capacitor, 390pf, 300V, Mica, 3%	45-003-021	El Menco	DM15F
C4B	Capacitor, 1500pf, 300V, Mica, 3%	45-004-005	El Menco	DM19F
Q2,Q1	Differential Amplifier, Silicon, NPN	50-004-002	Sprague	TD101
AR6	Differential Comparator	50-008-002	Motorola	MC1710CP
AR3,5	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR4	Hex Inverter	50-009-003	Motorola	MC789P
AR1,2	Dual J-K Flip-Flop	50-009-005	Motorola	MC790P

RATE MULTIPLIER BOARD 3A 04-126-518

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO.	MANUFACTURER	MFR. TYPE
R1,R2	Resistor, 2.2K Fixed Comp 1/4W, 5%	40-003-020	Allen-Bradley	CB
C1,C2	Capacitor, 270pf, Mica, 300V, 3%	45-003-017	El Menco	DM15F
C3	Capacitor, 50μf, 15V, Elect. Alum.,	45-215-053	Sprague	30D
AR6	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR2,AR3	Dual 4 Input Gate	50-009-002	Motorola	MC725P
AR5	Hex Inverter	50-009-003	Motorola	MC789P
AR4	Dual Buffer	50-009-004	Motorola	MC799P
AR7,8,9,10	Dual J-K Flip-Flop	50-009-005	Motorola	MC790P

RATE MULTIPLIER BOARD 3A 04-126-519

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR. TYPE
R1,R2	Resistor, 2.2K, Fixed Comp 1/4W, 5%	40-003-020	Allen-Bradley	CB
C1,C2	Capacitor, 270pf, Mica, 300V, 3%	45-003-017	El Menco	DM15F
C3	Capacitor, 50μf, 15V, Elect. Alum.,	45-215-053	Sprague	30D
AR6	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR2,AR3	Dual 4 Input Gate	50-009-002	Motorola	MC725P
AR5	Hex Inverter	50-009-003	Motorola	MC789P
AR4	Dual Buffer	50-009-004	Motorola	MC799P
AR7,8,9,10	Dual J-K Flip-Flop	50-009-005	Motorola	MC790P

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR.TYPE
	SWITCH & DIVIDER BOARD 1B 04-126-520			
C1	Capacitor, 50μf, Elect. Alum. 15V	45-215-053	Sprague	30D
AR15	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR1-12	Dual J-K Flip-Flop	50-009-007	Motorola	MC826P
	SWITCH & DIVIDER BOARD 2B 04-126-522			
R1-R4	Resistor, 2.2K, Fixed Comp, 1/4W, 5%	40-003-020	Allen-Bradley	CB
AR1	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR2	Dual 4 Input Gate	50-009-002	Motorola	MC725P

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR. TYPE
	SWITCH & DIVIDER BOARD 1B 04-126-521			
SW2-1B	Switch, P.C.	34-063-003	**	
C1	Capacitor, 50μf, Elect. Alum. 15V	45-215-053	Sprague	30D
AR13-15	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR1-12	Dual J-K Flip-Flop	50-009-007	Motorola	MC826P
	SWITCH & DIVIDER BOARD 2B 04-126-523			
SW1-2B, SW2-2B	Switch, P.C.	34-063-003	**	
R1-R5	Resistor, 2.2K, Fixed Comp, 1/4W, 5%	40-003-020	Allen-Bradley	CB
AR1	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR2	Dual 4 Input Gate	50-009-002	Motorola	MC725P
AR3	Hex Inverter	50-009-003	Motorola	MC789P

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR. TYPE
	SWITCH & DIVIDER BOARD 3B 04-126-524			
Q2	Transistor	30-011-021	**	
R2	Resistor, 1K, Fixed Comp, 1/4W, 5%	40-003-007	Allen-Bradley	CB
C1	Capacitor, 47μf, Mylar, 200V, 20%	45-130-202	Elpac	ZD2A474
C2	Capacitor, 50μf, Elect. Alum. 15V	45-215-053	Sprague	30D
AR5,AR7	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR6	Hex Inverter	50-009-003	Motorola	MC789P
AR1,2,3,4	Dual J-K Flip-Flop	50-009-005	Motorola	MC790P
	SWITCH & DIVIDER BOARD 4B 04-126-526			
C1	Capacitor, 50μf, Elect. Alum. 15V	45-215-053	Sprague	30D
AR5,AR7	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR6	Hex Inverter	50-009-003	Motorola	MC789P
AR1-AR4	Dual J-K Flip-Flop	50-009-005	Motorola	MC790P

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR.TYPE
	SWITCH & DIVIDER BOARD 3B 04-126-525			
Q2	Transistor	30-011-021	**	
SW1-3B, SW2-3B	Switch, P.C.	34-063-003	**	
R2	Resistor, 1K, Fixed Comp, 1/4W, 5%	40-003-007	Allen-Bradley	CB
R3,R4	Resistor, 2.2K, Fixed Comp, 1/4W, 5%	40-003-020	Allen-Bradley	CB
C1	Capacitor, .47μf, Mylar, 200V, 20%	45-130-202	Elpac	ZD2A474
C2	Capacitor, 50μf, Elect. Alum. 15V	45-215-053	Sprague	30D
AR5,AR7	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR6	Hex Inverter	50-009-003	Motorola	MC789P
AR1,2,3,4	Dual J-K Flip-Flop	50-009-005	Motorola	MC790P
	SWITCH & DIVIDER BOARD 4B 04-126-527			
SW1-4B, SW2-4B	Switch, P.C.	34-063-003	**	
C1	Capacitor, 50μf, Elect. Alum. 15V	45-215-053	Sprague	30D
AR5,AR7	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR6	Hex Inverter	50-009-003	Motorola	MC789P
AR1-AR4	Dual J-K Flip-Flop	50-009-005	Motorola	MC790P

FUNCTION GENERATOR 5B 04-126-528

REFERENCE DESIGNATION	DESCRIPITON	W-L PART NO	MANUFACTURER	MFR.TYPE
Q1	Transistor, NPN Silicon	30-095-001	Motorola	2N3904
R3	Resistor, 470Ω, Fixed Comp, 1/4W, 5%	40-003-006	Allen-Bradley	CB
R1	Resistor, 10K, Fixed Comp, 1/4W, 5%	40-003-013	Allen-Bradley	CB
R2	Resistor, 2.2K, Fixed Comp, 1/4W, 5%	40-003-020	Allen-Bradley	CB
C2	Capacitor, 50µf, Elect. Alum. 15V	45-215-053	Sprague	30D
C1	Capacitor, .01µf, Ceramic, 50V	45-902-001	Cramer	CK-103
AR6,8,9	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR5	Hex Inverter	50-009-003	Motorola	MC789P
AR7	Dual Buffer	50-009-004	Motorola	MC799P
AR1,2,3,4,10,11	Dual J-K Flip-Flop	50-009-005	Motorola	MC790P

FUNCTION GENERATOR 5B 04-125-529

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR. TYPE
Q1	Transistor NPN Silicon	30-095-001	Motorola	2N3904
SW2-5B	Switch, P.C.	30-063-003	**	
R3	Resistor, 470Ω, Fixed Comp, 1/4W, 5%	40-003-006	Allen-Bradley	CB
R1	Resistor, 10K, Fixed Comp, 1/4W, 5%	40-003-013	Allen-Bradley	CB
R2	Resistor, 2.2K, Fixed Comp, 1/4W, 5%	40-003-020	Allen-Bradley	CB
C1	Capacitor, .01μf, Ceramic, 50V	45-902-001	Cramer	CK-103
C2	Capacitor, 50μf, Elect. Alum. 15V	45-215-053	Sprague	30D
AR6,8,9	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR5	Hex Inverter	50-009-003	Motorola	MC789P
AR7	Dual Buffer	50-009-004	Motorola	MC799P
AR1,2,3,4,10,11	Dual J-K Flip-Flop	50-009-005	Motorola	MC790P

CLOCK & DISPLAY 6B 04-126-530

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR. TYPE
Q1,Q2	Transistor	30-011-021	**	
Q4	Transistor, NPN Silicon	30-095-001	Motorola	2N3904
Q3	Transistor, PNP Silicon	30-089-001	Gen.,Elect.	2N2646
CR1	Diode 200MA, 120PIV, Silicon	35-001-001	Fairchild	1N658
R4	Resistor, 330Ω, Fixed Comp, 1/4W, 5%	40-003-003	Allen-Bradley	CB
R7	Resistor, 10K, Fixed Comp, 1/4W, 5%	40-003-013	Allen-Bradley	CB
R6	Resistor, 47Ω, Fixed Comp, 1/4W, 5%	40-003-016	Allen-Bradley	CB
R1,2,9,10,11	Resistor, 2.2K, Fixed Comp, 1/4W, 5%	40-003-020	Allen-Bradley	CB
R17	Resistor, 220Ω, Fixed Comp, 1/4W, 5%	40-003-022	Allen-Bradley	CB
R12,R13	Resistor, 33K, Fixed Comp, 1/4W, 5%	40-003-025	Allen-Bradley	CB
R5	Resistor, 680Ω, Fixed Comp, 1/4W, 5%	40-003-030	Allen-Bradley	CB
R8	Resistor, 1.5K, Fixed Comp, 1/4W, 5%	40-003-032	Allen-Bradley	CB
C3,C4	Capacitor, .01μf, Ceramic, 50V	45-902-001	Cramer	CK-103
C6	Capacitor, 50μf, Elect. Alum. 15V	45-215-053	Sprague	30D
C2	Capacitor, 5μf, Elect. Alum. 25V	45-215-006	Sprague	30D
C1	Capacitor, 50μf, Elect. Alum. 25V	45-215-004	Sprague	30D
C8	Capacitor, .22μf, Mylar, 50V, 20%	45-130-509	Elpac	ZD54394
AR1	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR4	Hex Inverter	50-009-003	Motorola	MC789P
AR5,6,7	Dual Buffer	50-009-004	Motorola	MC799P
AR2,3	Dual J-K Flip-Flop	50-009-005	Motorola	MC790P

CLOCK & DISPLAY 6B 04-126-531

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR. TYPE
Q1,Q2	Transistor	30-011-021	**	
Q4,5,6	Transistor, NPN Silicon	30-095-001	Motorola	2N3904
Q3	Transistor, PNP Silicon	30-089-001	Gen. Elect.	2N2646
SW2-6B	Switch, P.C.	34-063-003	**	
CR1	Diode, 200MA, 120PIV, Silicon	35-001-001	Fairchild	1N658
CR2	Diode, 10MA, 100PIV, Silicon	35-005-001	Texas Inst.	1N916
R4	Resistor, 330Ω, Fixed Comp, 1/4W, 5%	40-003-003	Allen-Bradley	CB
R16	Resistor, 1K, Fixed Comp, 1/4W, 5%	40-003-007	Allen-Bradley	CB
R7	Resistor, 10K, Fixed Comp, 1/4W, 5%	40-003-013	Allen-Bradley	CB
R6	Resistor, 47Ω, Fixed Comp, 1/4W, 5%	40-003-016	Allen-Bradley	CB
R1,2,3,9,10,11,14,15	Resistor, 2.2K, Fixed Comp, 1/4W, 5%	40-003-020	Allen-Bradley	CB
R17	Resistor, 220Ω, Fixed Comp, 1/4W, 5%	40-003-022	Allen-Bradley	CB
R12,R13	Resistor, 33K, Fixed Comp, 1/4W, 5%	40-003-025	Allen-Bradley	CB
R5	Resistor, 680Ω, Fixed Comp, 1/4W, 5%	40-003-030	Allen-Bradley	CB
R8	Resistor, 1.5K, Fixed Comp, 1/4W, 5%	40-003-032	Allen-Bradley	CB
C3,4,5	Capacitor, .01μf, Ceramic, 50V	45-902-001	Cramer	CK-103
C6	Capacitor, 50μf, Elect. Alum, 15V	45-215-053	Sprague	30D
C2	Capacitor, 5μf, Elect. Alum, 25V	45-215-006	Sprague	30D
C1	Capacitor, 50μf, Elect. Alum, 25V	45-215-004	Sprague	30D
C8	Capacitor, .22μf, Mylar, 50V, 20%	45-130-509	Elpac	ZD54394
AR1,AR8	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR4	Hex Inverter	50-009-003	Motorola	MC789P
AR5,6,7	Dual Buffer	50-009-004	Motorola	MC799P
AR2,3	Dual J-K Flip-Flop	50-009-005	Motorola	MC790P

POWER SUPPLY BOARD 7B 04-126-532

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR.TYPE
Q2,5,6	Transistor, PNP Silicon	30-038-001	Motorola	2N3906
Q3,Q4	Transistor, NPN Silicon	30-095-001	Motorola	2N3904
CR7	Diode, 1a, 100V, Silicon Rectifier	35-003-001	IRC	1N3254
CR1	Diode, 1a, 6.8V, Silicon Reference,	35-052-009	Motorola	MZ1000-9
CR2	Diode, 1a, 12V, Silicon Reference,	35-052-015	Motorola	MZ1000-15
CR3-CR6	Diode, 1a, 100V, Silicon Rectifier	35-055-003	Motorola	1N4002
R14,22,23	Resistor, 332Ω, 1W, 1%, Film	40-002-039	IRC	CEC
R15,20,21	Resistor, 681Ω, 1W, 1%, Film	40-002-049	IRC	CEC
R3	Resistor, 8.2K, Fixed Comp, 1/4W, 5%	40-003-011	Allen-Bradley	CB
R1,11,12,13	Resistor, 10K, Fixed Comp, 1/4W, 5%	40-003-013	Allen-Bradley	CB
R7,8	Resistor, 4.7K, Fixed Comp, 1/4W, 5%	40-003-018	Allen-Bradley	CB
R2	Resistor, 47K, Fixed Comp, 1/4W, 5%	40-003-028	Allen-Bradley	CB
R9	Resistor, 2.7K, Fixed Comp, 1/4W, 5%	40-003-042	Allen-Bradley	CB
R17	Resistor, 100K, Power, 2W, 5%	40-218-004	Allen-Bradley	HB
R10	Resistor, 1K, Variable, W-W, 10%	40-426-001	Bournes	3067P
C1	Capacitor, 15pf, Mica, 300V, 5%	45-001-006	El Menco	DM 15C
C6	Capacitor, 47pf, Mica, 300V, 3%	45-002-005	El Menco	DM 15E
C8	Capacitor, 22pf, Mica, 300V, 3%	45-002-002	El Menco	DM 15E
C7	Capacitor, Mica, Trim, 300V, 3%	*	El Menco	DM 15F
C10	Capacitor, Mica, 470pf, 300V, 3%	45-003-023	El Menco	DM 15F
C9	Capacitor, 1μf, Tantalum, 35V, 20%	45-401-001	Mallory	TAS105
C5	Capacitor, 5.5-18pf, Variable	45-504-003	Erie	538
C2,C3	Capacitor, .01μf, Ceramic, 50V	45-902-001	Cramer	CK-103
AR2	Differential Amplifier Comparator	50-008-002	Motorola	MC1710CP

POWER SUPPLY BOARD 7B 04-126-533

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR.TYPE
Q2,Q5,Q6	Transistor, PNP Silicon	30-038-001	Motorola	2N3906
Q1,Q3,Q4	Transistor, NPN Silicon	30-095-001	Motorola	2N3904
CR7	Diode, 1a, 100V, Silicon Rectifier	35-003-001	IRC	1N3254
CR1	Diode, 1a, 6.8V, Silicon Reference,	35-052-009	Motorola	MZ1000-9
CR2	Diode, 1a, 6.8V. Silicon Reference,	35-052-015	Motorola	MZ1000-15
CR3-CR6	Diode, 1a, 100V, Silicon Rectifier	35-055-003	Motorola	1N4002
R14,22,23	Resistor, 332Ω, Film, 1W, 1%	40-002-039	IRC	CEC
R15,20,21	Resistor, 681Ω, Film, 1W, 1%	40-002-049	IRC	CEC
R3	Resistor, 8.2K, Fixed Comp, 1/4W, 5%	40-003-011	Allen-Bradley	CB
R1,11,12,13	Resistor, 10K, Fixed Comp, 1/4W, 5%	40-003-013	Allen-Bradley	CB
R4,7,8	Resistor, 4.7K, Fixed Comp, 1/4W, 5%	40-003-018	Allen-Bradley	CB
R5,18,19	Resistor, 2.2K, Fixed Comp, 1/4W, 5%	40-003-020	Allen-Bradley	CB
R2	Resistor, 47K, Fixed Comp, 1/4W, 5%	40-003-028	Allen-Bradley	CB
R9	Resistor, 2.7K, Fixed Comp, 1/4W, 5%	40-003-042	Allen-Bradley	CB
R17	Resistor, 100K, Power, 2W, 5%	40-218-004	Allen-Bradley	HB
R10	Resistor, 1K, Variable, W-W, 10%	40-426-001	Bournes	3067P
C1	Capacitor, 15pf, Mica, 300V, 5%	45-001-006	E1 Menco	DM 15C
C6	Capacitor, 47pf, Mica, 300V, 3%	45-002-005	E1 Menco	DM 15E
C8	Capacitor, 22pf, Mica, 300V, 3%	45-002-002	E1 Menco	DM 15E
C7	Capacitor, Mica, Trim, 300V, 3%	*	E1 Menco	DM 15F
C10	Capacitor, 470pf, Mica, 300V, 3%	45-003-023	E1 Menco	DM 15F
C9	Capacitor, 1μf, Tantalum, 35V, 20%	45-401-001	Mallory	TAS105
C5	Capacitor, 5.5-18pf, Variable	45-504-003	Erie	538
C2,C3	Capacitor, .01μf, Ceramic, 50V	45-902-001	Cramer	CK-103
AR2	Differential Amplifier Comparator	50-008-002	Motorola	MC1710CP
AR1	Quad 2 Input Gate	50-009-001	Motorola	MC724P

DECADE BOARD D1 thru D6 04-126-536

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR. TYPE
Q1	Transistor, NPN Silicon	30-093-001	Motorola	2N4410
R5	Resistor, 2.2K, Fixed Comp. 1/4W, 5%	40-003-020	Allen-Bradley	CB
R1,2,3,4	Resistor, 3.01K, Fixed Comp. 1/8W, 1%	40-015-066	IRC	RN55D
C1,2,3,4	Capacitor, 470pf, Mica, 300V, 3%	45-003-023	El Menco	DM 15F
C5	Capacitor, 680pf, Mica, 300V, 3%	45-003-027	El Menco	DM 15F
C6	Capacitor, 50µf, Elect. Alum. 15V	45-215-053	Sprague	30D
AR12,5	Quad 2 Input Gate	50-009-001	Motorola	MC724P
AR7	Dual 4 Input Gate	50-009-002	Motorola	MC725P
AR6	Hex Inverter	50-009-003	Motorola	MC789P
AR8	Dual Buffer	50-009-004	Motorola	MC799P
AR1,2,3,4,10,11	Dual J-K Flip-Flop	50-009-005	Motorola	MC790P
AR9	Three Input Gates	50-009-006	Motorola	MC792P

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR. TYPE
	BACKBOARD 04-126-534			
XCR1	Crystal, 2MC	26-010-001	James Knight	HC-6/μ
X1-X6	Socket, 16 Pin P.C. Mtg.	29-039-001	Burroughs	SK196
X7	Crystal Socket, 2 Pin	29-071-001	Augat	8000
R1-R6	Resistor, 39K, Fixed Comp, 1/4W, 5%	40-003-027	Allen-Bradley	CB
C11	Capacitor, 1μf, 200V, 20%, Mylar, Metallized	45-122-201	Good-All	X663
C9,C10	Capacitor, 500μf, 25V, Electrotylic	45-225-101	Cornell Dublier	BR500-25
C1	Capacitor, 31,000μf, 15V, Elect. Alum, Power	45-218-151	Sprague	36D
C2,C3	Capacitor, 4600μf, 15V, Elect. Alum, Power	45-219-002	Gen. Elec.	86F
C8	Capacitor, 30μf, 350V, Alum, Electrolytic	45-226-651	Sprague	44D
AR1,AR5	Decorder Driver Integrated Circuit	50-010-001	Fairchild	CμL9960
	COMPONENT BOARD 04-126-534			
DS2,4	Neon Glow Lamps, 105-125V	37-009-001	Gen. Elec.	NE-2H
R2	Resistor, 47K, Fixed Comp, 1/4W, 5%	40-003-028	Allen-Bradley	CB
R3,6	Resistor, 100K, Fixed Comp, 1/4W, 5%	40-003-031	Allen-Bradley	CB
R1	Resistor, 120K, Fixed Comp, 1/4W, 5%	40-003-049	Allen-Bradley	CB
R5	Resistor, 680K, Fixed Comp, 1/4W, 5%	40-003-047	Allen-Bradley	CB

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANFUACTURER	MFR. TYPE
	BACKBOARD 04-126-535			
XCR1	Crystal, 2MC	26-010-001	James Knight	HC-6/μ
X1-X6	Socket, 16 Pin, P.C. Mtg.	29-039-001	Burroughs	SK196
X7	Crystal Socket, 2 Pin	29-071-001	Augat	8000
R1-R6	Resistor, 39K, Fixed Comp, 1/4W, 5%	40-003-027	Allen-Bradley	CB
C11	Capacitor, 1μf, 200V, Mylar, 20%, Metallized	45-122-201	Good-All	X663
C9,C10	Capacitor, 500μf, 25V, Electrolytic	45-225-101	Cornell-Dublier	BR500-25
C1	Capacitor, 31,000μf, 15V, Elect. Alum, Power	45-218-151	Sprague	36D
C2,C3	Capacitor 4600μf, 15V, Elect. Alum, Power	45-219-002	Gen. Elec.	86F
C8	Capacitor, 30μf, 350V, Alum. Electrolytic	45-226-651	Sprague	44D
AR1-AR5	Decorder Driver Integrated Circuit	50-010-001	Fairchild	CμL9960
	COMPONENT BOARD 04-126-535			
DS1,2,3,4	Neon Glow Lamps 105-125V	37-009-001	Gen. Elec.	NE-2H
R2	Resistor, 47K, Fixed Comp, 1/4W, 5%	40-003-028	Allen-Bradley	CB
R3,6	Resistor, 100K, Fixed Comp, 1/4W, 5%	40-003-031	Allen-Bradley	CB
R1	Resistor, 120K, Fixed Comp, 1/4W, 5%	40-003-049	Allen-Bradley	CB
R4,5	Resistor, 680K, Fixed Comp, 1/4W, 5%	40-003-047	Allen-Bradley	CB

FRAME ASSEMBLY 04-126-514

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR.TYPE
	Top & Bottom Cover	03-100-157-1	Weston	Reference
	Side Cover	03-100-158-4	Weston	Reference
	Corner Trim	03-100-160-2	Weston	Reference
	Front Panel	08-126-196	Weston	Reference
	Rear Panel	08-126-236	Weston	Reference
	Filter Cover	03-126-182	Weston	Reference
	Filter	20-126-183	Weston	Reference
	Mark. Knob .700 Dia.	08-126-187-1	Weston	Reference
	Display Bezel	03-126-202	Weston	Reference
	Display Filter Retainer	03-126-203	Weston	Reference
	Display Filter	18-126-204	Weston	Reference
	Assembly Bezel and Filter	02-126-205	Weston	Reference
B1	Fan and Motor Assembly	26-012-001	Weston	Reference
T1	Transformer	27-347-001	Weston	Reference
	Housing-Scale Assembly	02-126-240	Weston	Reference
J1	Connector, Power, Recept. Male	29-052-001	Tower Mfg.	1016-1
Q1	Transistor, NPN, Silicon	30-042-001	RCA	2N3055
Q2	Transistor, NPN Silicon	30-052-002	Motorola	MJ2250
XF1	Fuse Holder	33-001-001	Littlefuse	342012
F1	Fuse,75A,Slo Blo	33-010-007	Buss	MDL
SW3	Switch, Push-Button, SPST	34-077-001	Arrowhart	86710C
SW2	Switch Assy Rotary, 3 Pole, 2 Position	34-076-002	Stackpole	
CR1&CR2	Diode,1a,100V, Silicon Rectifier	35-022-001	RCA	1N1204A

FRAME ASSEMBLY 04-126-514 CONTINUED

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR. TYPE
	Line Cord, 8 Ft., Power Line, 3 Wire	31-800-003	Belden	17258
DS1-DS6	Indicator Tube	39-001-001	Burroughs	B5441
R14	Resistor, 0.5Ω, 10W, ±5%	40-203-105	Memcor	MCR-10
SW10&R1	Sw. & Pot Assembly 150K	40-424-001	Stackpole	'L'
C101A&B	Capacitor, 2X.01μf, 125V Ceramic	45-901-001	Sprague	36C219
TB1	Connector, Terminal Block	58-009-008	Kulka	410C

FRAME ASSEMBLY 04-126-539

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR. TYPE
	Top & Bottom Cover	03-100-157-1	Weston	Reference
	Side Cover	03-100-158-4	Weston	Reference
	Corner Trim	03-160-160-2	Weston	Reference
	Front Panel	08-126-198	Weston	Reference
	Rear Panel	08-126-236	Weston	Reference
	Filter Cover	03-126-182	Weston	Reference
	Filter	20-126-183	Weston	Reference
	Mark. Knob .700 Dia.	08-126-187-1	Weston	Reference
	Mark. Knob .700 Dia.	08-126-187-2	Weston	Reference
	Mark. Concentric Knob	08-126-188	Weston	Reference
B1	Fan & Motor Assembly	26-012-001	Weston	Reference
	Display Bezel	03-126-202	Weston	Reference
	Display Filter Retainer	03-126-203	Weston	Reference
	Display Filter	18-126-204	Weston	Reference
	Assembly Bezel & Filter	02-126-205	Weston	Reference
	Housing-Scale Assembly	02-126-240	Weston	Reference
T1	Transformer	27-347-001	Weston	Reference
J2,3,4,5	Connector BNC, Recept	29-037-001	Dage	667-2
J1	Connector, Power, Receptacle, Male	29-052-001	Tower Mfg.	1061-1
Q1	Transistor, NPN, Silicon	30-042-001	RCA	2N3055
Q2	Transistor, NPN Silicon	30-052-002	Motorola	MT2250
XF1	Fuse Holder	33-001-001	Littlefuse	342012
F1	Fuse 75A Slo Blo 3/4A	33-010-007	Buss	MDL

FRAME ASSEMBLY CONTINUED 04-126-539

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO.	MANUFACTURER	MFR. TYPE
SW3	Switch, Push-Button SPST	34-077-001	Arrowhart	86710C
SW9,SW5	Switch Slide, Double Pole, Double Throw	34-062-002	Stackpole	SS-50
	Detent	34-063-999-6	Weston	
	Detent	34-063-999-7	Weston	
SW6&R2	Pot & Sens. Switch Rotary 4 Position	34-073-002	Weston	
CR1,CR2	Diode 1a 100V Silicon Rectifier	35-022-001	RCA	1N1204A
	Line Cord 8Ft. Power Line 3 Wire	31-800-003	Belden	17258
DS1-DS6	Indicator Tube	39-001-001	Burroughs	B5441
R14	Resistor, 0.5Ω, 10W, ±5%	40-203-105	Memcor	MOR-10
SW10 & R1	Sw. & Pot. Assembly 150K	40-424-001	Stackpole	'L'
R13	Resistor, 10K, 2W, 5%, Power	40-218-005	Allen-Bradley	HB
C13	Capacitor, 680pf, Mica, 300V, 3%	45-003-027	El Menco	DM15F
C101A&B	Capacitor, 2X.01μf, 125V, Ceramic	45-901-001	Sprague	36C219
TB1	Connector, Terminal Block	58-009-008	Kulka	410C

FRAME ASSEMBLY 04-126-515

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR.TYPE
	Top & Bottom Cover	02-100-157-1	Weston	Reference
	Side Cover	02-100 158-4	Weston	Reference
	Corner Trim	02-100 160-2	Weston	Reference
	Front Panel	08-126-238	Weston	Reference
	Rear Panel	08-126-236	Weston	Reference
	Filter Cover	03-126-182	Weston	Reference
	Filter	20-126-183	Weston	Reference
	Mark. Knob .700 Dia.	08-126-187-1	Weston	Reference
	Mark. Knob .700 Dia.	08-126-187-2	Weston	Reference
	Mark. Concentric Knob	08-126-188	Weston	Reference
B1	Fan & Motor Assembly	26-012-001	Weston	Reference
	Display Bezel	02-126-202	Weston	Reference
	Display Filter Retainer	03-126-203	Weston	Reference
	Display Filter	08-126-204	Weston	Reference
	Assembly Bezel & Filter	02-126-205	Weston	Reference
	Housing-Scale Assembly	02-126-240	Weston	Reference
T1	Transformer	27-347-001	Weston	Reference
J2,3,4,5	Connector, BNC Recept.	29-037-001	Dage	667-C
J1	Connector, Power Recept. Male	29-052-001	Tower Mfg.	1061-1
Q1	Transistor, NPN, Silicon	30-042-001	RCA	2N3055
Q2	Transistor, NPN Silicon	30-052-002	Motorola	MJ2050
XF1	Fuse Holder	33-001-001	Littlefuse	342012
F1	Fuse, 75A. Slo Blo	33-010-007	Buss	MDL

FRAME ASSEMBLY 04-126-515 CONTINUED

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO	MANUFACTURER	MFR. TYPE
SW-7	Switch, Push-Button, 1 Pole, Momentary	34-020-001	Grayhill	
SW-3	Switch, Push-Button, SPST	34-077-001	Arrowhart	86710C
SW9, SW5	Switch, Slide, Double Pole, Double Throw	34-062-002	Stackpole	SS-50
	Detent	34-063-999-7	Weston	
	Detent	34-063-999-8	Weston	
SW6&R2	Pot & Sens. Switch, Rotary, 2 Pole, 4 Position	34-073-002	Stackpole	
CR1&CR2	Diode 1a 100V Silicon Rectifier	35-022-001	RCA	
	Line Cord 8 Ft. Power Line 3 Wire	31-800-003	Belden	17258
DS1-DS6	Indicator Tube	39-001-001	Burroughs	B5441
R14	Resistor, 0.5Ω, 10W, ±5%	40-203-105	Memcor	MCR-10
SW10&R1	Sw. & Pot. Assembly 150K	40-424-001	Stackpole	'L'
R13	Resistor, 2W, 10K, 5% Power	40-218-005	Allen-Bradley	HB
C13	Capacitor, Mica, 680pf, 300V, 3%	45-003-027	El Menco	DM15F
C101A&B	Capacitor, Ceramic, 2X.01μf 12V	45-901-001	Sprague	36C219
TB1	Connector, Terminal Block	58-009-008	Kulka	410C

ACCESSORY LIST

REFERENCE DESIGNATION	DESCRIPTION	W-L PART NO.	MANUFACTURER	MFR. TYPE
	Rack Mounting Ears	03-117-280-2	Weston	--
	Tilt Stand Assembly	02-100-178	Weston	--
	Extender Board	13-117-179	Weston	--

SECTION 7

BCD PRINTER DRIVE

7.0 OPTION D - BCD PRINTER DRIVE

This section of the manual describes the connection and operation of optional devices in the Series 300 Frequency Counters which read out electrical signals for activating printers.

7.1 PRINTER DRIVE SIGNALS AND TIMING

The printer drive signals are available at multi-pin connector J-6 on the rear panel. The signals consist of:

(1) The numerical value of the quantity in 1-2-4-8 decimal code; there are six such decimal digits (24 output lines). The exponent of the decimal multiplier n having the value, 0, -1, -2, -3, -4 is also expressed as a BCD digit in 1-2-4-8 code. (a total of 3 output lines).

(2) Operating Mode (as applicable)

Hz

kHz

μ sec

self-check

each having a separate line (four lines).

(3) Overrange Indication (computed frequency only)

Frequency too high

Frequency too low

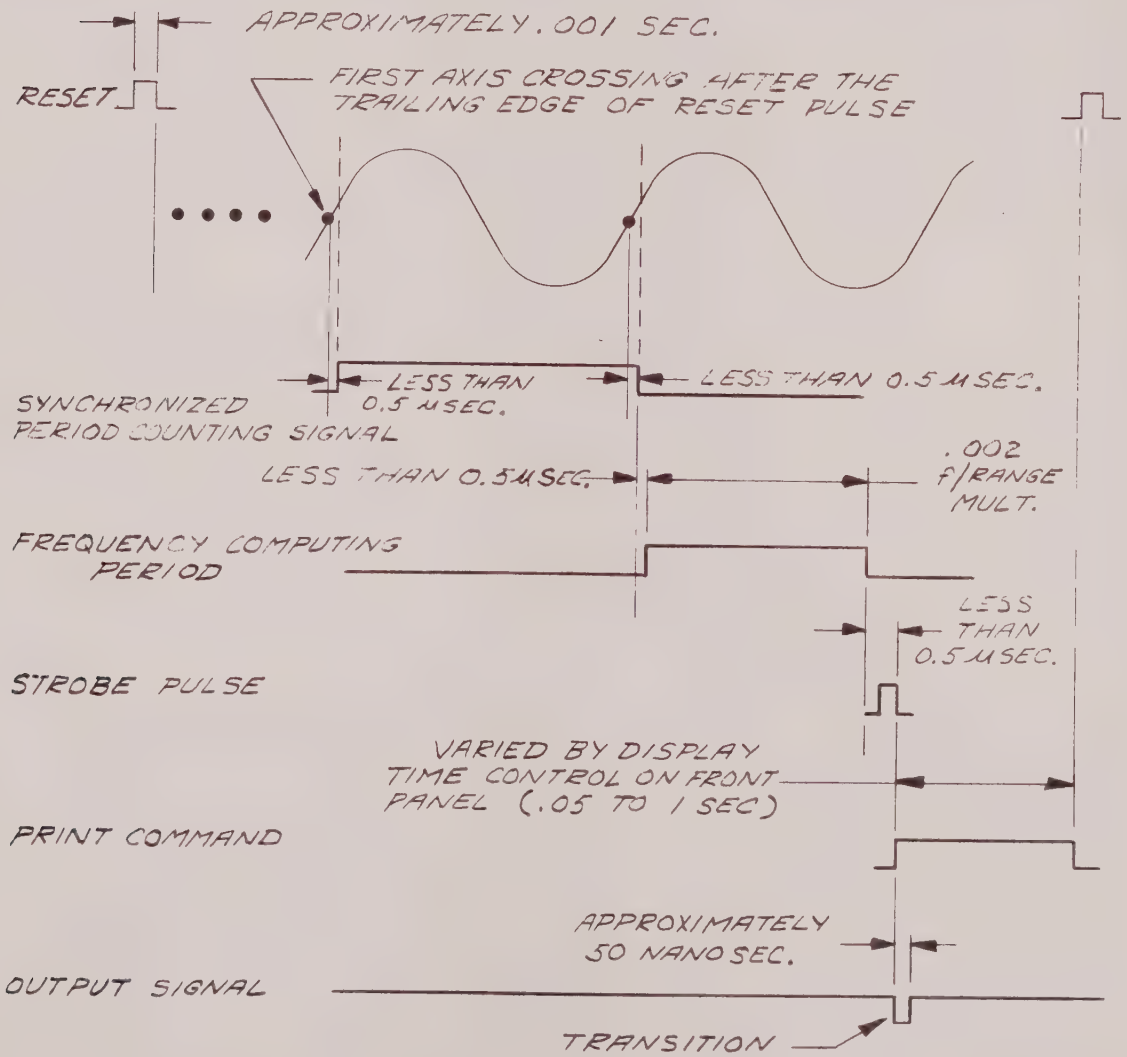
each having a separate line (two lines)

(4) A Print Command Signal (one line).

(5) A Ground or Return for the above signals,

a total of 35 lines.

Typical timing of the signals follows figure 4-2 and is further provided by figure 7-1. Decimal outputs are available all the time, changing value immediately after the trailing edge of the Strobe pulse in a transition time of 50 nanoseconds. The Print Command Signal occurs immediately thereafter and lasts a controllable time (from .05 to 1 second). After the Print Command signal, the Reset pulse occurs (which does not affect the printer output signals)* and a new frequency measurement cycle is begun - when the first axis crossing occurs. From the first axis crossing to the Strobe pulse is the measurement time as described in section 4-3. The rise time of the Print Command signal is less than 1 μsec with a 200 μμf capacitive load across the line.



Timing of Printer Drive Signals in Computed Frequency Mode

Figure 7-1

* The unit's overrange output is reset to zero by the Reset pulse; if the 6- nines option is incorporated, the Reset pulse does not affect the output signals.

If the Display Time control is turned full clockwise, the counter holds the latest computed value indefinetely.

Other characteristics are as described in paragraph 2.5.3

7.2 TABLE OF CONNECTION ON J-6

The connections on J-6 are as follows:

Digit		Pin Number
Units	1	24
	2	23
	4	22
	8	21
Tens	1	20
	2	19
	4	18
	8	17
Hundreds	1	16
	2	15
	4	14
	8	13
Thousands	1	12
	2	11
	4	10
	8	9
Ten Thousands	1	8
	2	7
	4	6
	8	5
Hundred Thousands	1	4
	2	3
	4	2
	8	1

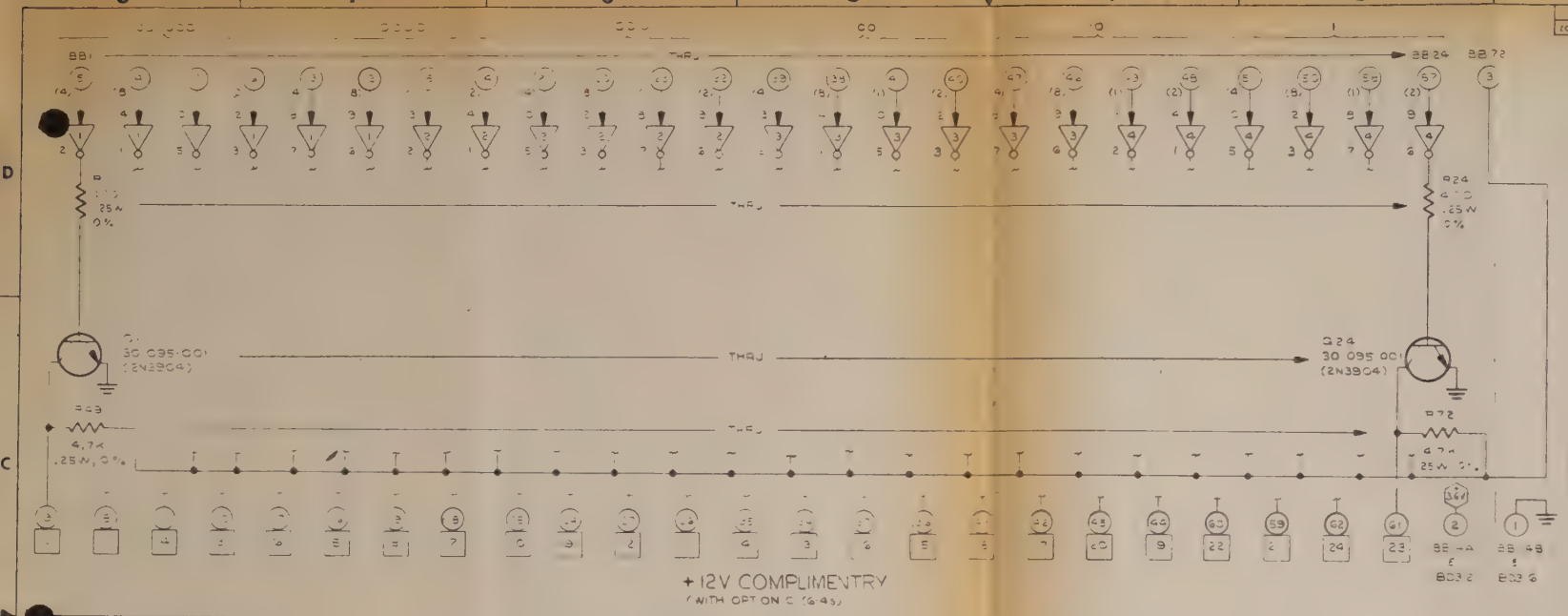
Digit	Pin Number
Decimal Exponent	
-1	50
-2	49
-4	45
Function	
Hz	28
kHz	27
µsec	30
Self-Check	26
Off Scale	
Frequency too high	48
Frequency too low	47
Print Command	46
Gnd & Return	29

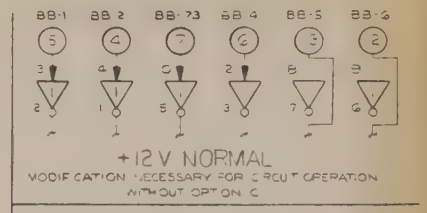
The mating connector to J-6 is P/N 57-30500 manufactured by Amphenol.

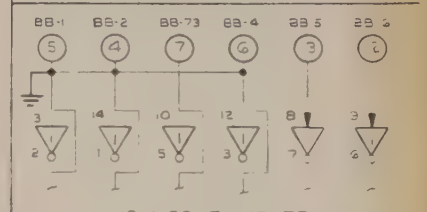
7.3 SCHEMATIC DRAWINGS

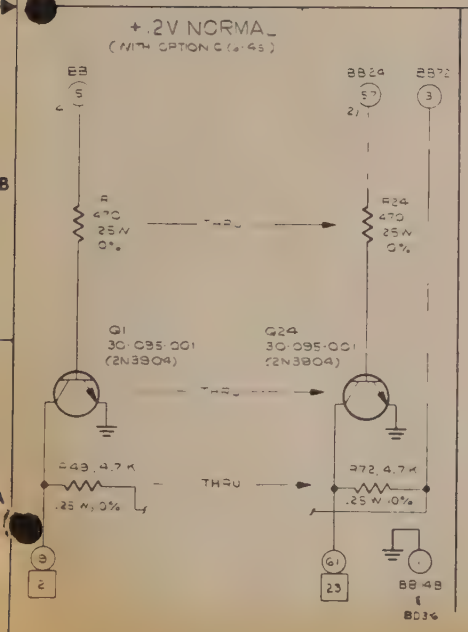
The schematic drawings describing the BCD Printer Drive option are:

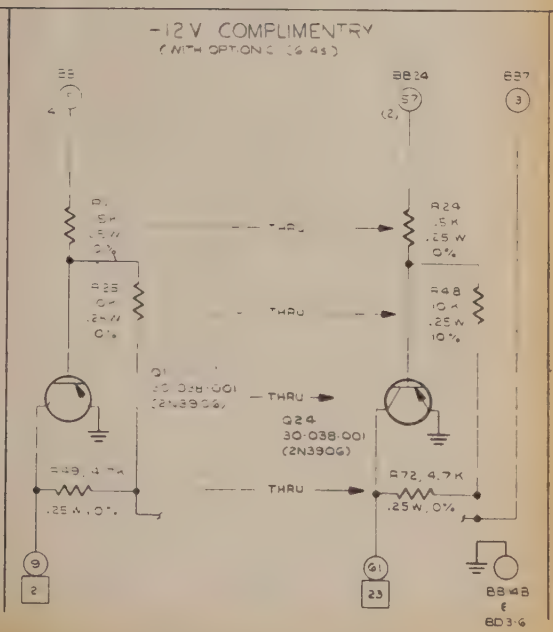
04-126-537
04-126-538

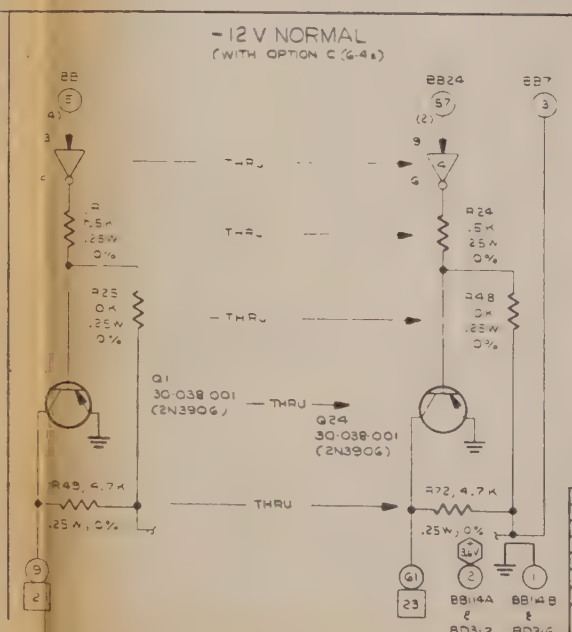












NOTES

1. UNLESS OTHERWISE SPECIFIED
   - A. IC'S ARE 50 009 003
   - B. IC 5-PIN 11 IS CONNECTED TO +3.6V
   - C. IC'S-PIN 4 IS CONNECTED TO GND

2. SYMBOL IDENTIFICATION
   - A. ○ - INDICATES INTERNAL BD PIN
   - B. ⬡ - INDICATES INTERNAL VOLTAGE CONNECTION.
   - C. BB - INDICATES BACKBOARD CONNECTION.
   - D. BD3 - INDICATES OPTION BOARD 3 CONNECTION.
   - E. □ - INDICATES JG CONNECTION.

CONTRACT AUTHENTICATION	DATE
DRN R. ROGERS	10-21-68
CHK C.V. Baramowski	11-21-68
REVIEW	
ENGR	
APPD	

WESTON - BOTEK

DEF 8 M 23 26-220

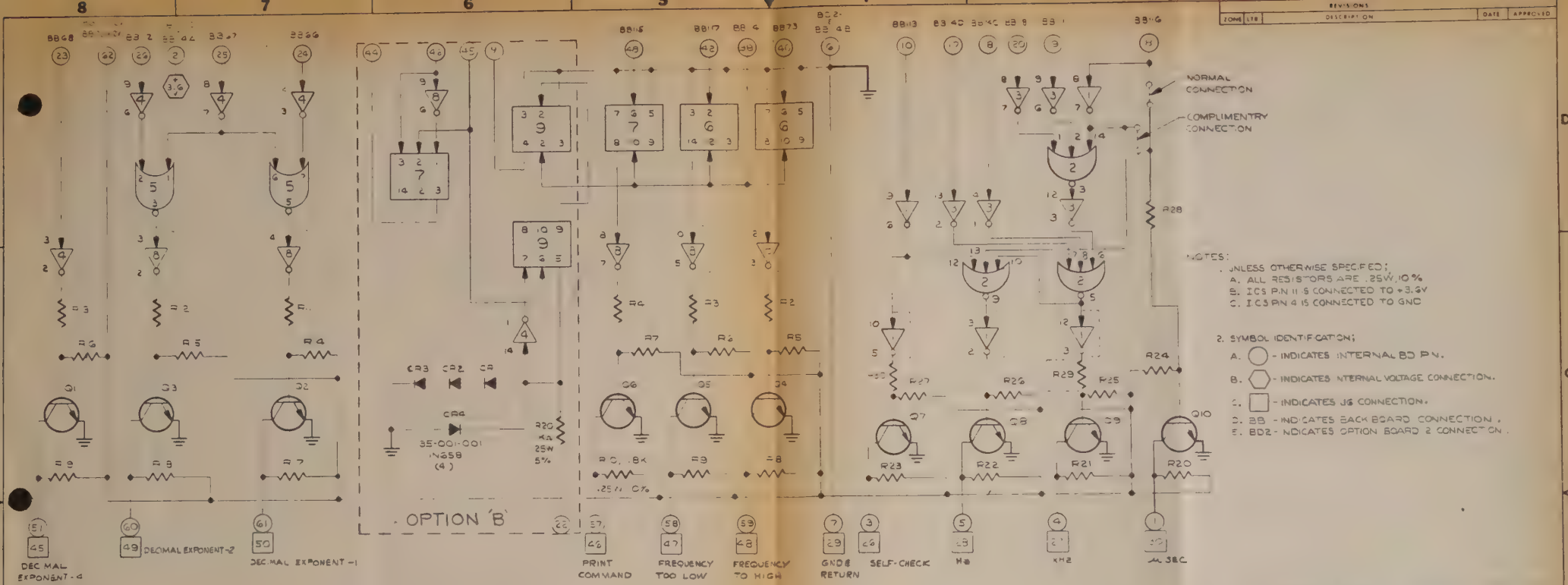
WESTON INSTRUMENTS INC.
LEXINGTON DIVISION LEXINGTON MASS

SCH., OPTION 'D' BD 2
DRO
MODEL 300, 301 & 302

SIZE	CODE IDENT NO.	DRAWING NO.
D	11842	04-126-537-A

SCALE NONE | UNIT WT | SHEET 1 OF 2

04-126-537-A-1



NOTES:

1. UNLESS OTHERWISE SPECIFIED;
   A. ALL RESISTORS ARE .25W,10%
   B. IC'S P.N 11-8 CONNECTED TO +3.6V
   C. IC'S PIN 4 IS CONNECTED TO GND
2. SYMBOL IDENTIFICATION;
   A. ◯ - INDICATES INTERNAL BD P.N.
   B. ⬡ - INDICATES INTERNAL VOLTAGE CONNECTION.
   C. □ - INDICATES J& CONNECTION.
   D. BB - INDICATES BACK BOARD CONNECTION.
   E. BD2 - INDICATES OPTION BOARD 2 CONNECTION.

SELECTION CHART

COMPONENT DESIGNATION	OPERATION			
	+2V C	-2V N	-2V C	-2V N
R2-4, R11-13, R28-30	470Ω	470Ω	1.5KΩ	1.5KΩ
R5-7, R14-16, R24-27	NOT USED	NOT USED	OKΩ	OKΩ
R8, R9, R17-23	4.7KΩ	4.7KΩ	4.7KΩ	4.7KΩ
Q1 THRU Q10	30-085-001 2N3904	30-085-001 2N3904	30-038-001 2N3906	30-038-001 2N3906
JUMPERS (TO BE ADDED ACROSS I.C. PINS)	ARI - 2E13, 3E12, 5E10	ARI - 2E13, 3E12, 5E10; REMOVE AR8 & ADD JUMPERS 7E8, 5E10, 3E12	ARI - 2E13, 3E12, 5E10; REMOVE AR4 & AR8 & ADD JUMPERS 2E13, 1E14, 7E8, 5E10, 3E12	ARI - 2E13, 3E12, 5E10

CONTRACT AUTHENTICATION	DATE	
DRN R. ROGERS	6-11-68	WESTON INSTRUMENTS, INC. LEXINGTON DIVISION LEXINGTON MASS
CHK C.V. Baranger	11-29-68	SCH., OPTION 'D' & 'B' BD 3 DRO MODEL 300, 301 & 302
REVIEW		
ENGR		
APPD		
WESTON-ROTEX 19		SIZE D · CODE IDENT NO. 11842 · DRAWING NO. 04-126-538-A
		SCALE NONE · UNIT WT · SHEET 1 OF 1

REF DWG 23-113-260

SECTION 8

SIX NINES (OPTION C)

8.0 SIX NINES OPTION

This section describes the connections and operation of the Model 302 Frequency Counter with the option providing six nine digit decimal readout in Axis-Crossing Frequency and Period Measurements. Thus readings of frequency, such as

999999 Hz

can be made.

8.1 CONNECTIONS

To insert the sixth digit a sixth decade board is added in position D-6. Referring to Block Diagram 04-126-515, the sixth decade is added by connecting from pin 26 of D-5 to pin 25 of D-6; the connection from pin 26 on D-5 to pin 7 of board 6B remains. The connection from pin 1 of 6B to pin 2 of D5-6 is removed; connections are made from pins 4, 5, 6 and 8 to Nixie Decoder Driver D-6, and then from D-6 to DS-6 as shown typically connected on D-1. The schematic of Decade D-6 is identical to that of D-1 through D-5 as shown on drawing 04-126-536, with the exception that IC-8 is removed. There is no connection to pins 26 or 36. Oven XCR-1, R12, C12, and jumper are added as shown on 04-126-535. Locations are as shown on Drawing 11-126-242.

8.2 OPERATION

The 302 Frequency Counter is used as described in Section 3.4. In the Computed Frequency Mode "Off Scale" readings too high cause an "Off Scale" indication, and the display indicates 200000. Off Scale reading too low cause an "Off Scale" indication, and the display indicates 00000.

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